Chapter – 4

Environmental Audit : An Empirical Analysis of Industries in Sangli District

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ENVIRONMENTAL AUDIT : AN EMPIRICAL ANALYSIS OF INDUSTRIES IN SANGLI DISTRICT

4.1 Introduction

Maharashtra Industrial Development Corporations are the premier organisation for developing industrial areas in general in Maharashtra and in particular in Western Maharashtra along with Sangli district. In last few decades, rapid industrialization has resulted in increased discharge of liquid solids, gaseous emissions into the environment.[1] Hence, it is necessary to tackle the problem of environmental pollution at city or district level. Therefore, in present chapter, an attempt has made to give empirical analysis of environmental auditing by industries in Sangli district.

4.2 A Profile of Sampled Industries

Sangli district is one of the industrially developed districts in general in Maharashtra and in particular in Western Maharashtra. The Sangli district comprises of 10 talukas, among which Miraj, Palus, Walwa, Shirala and Kavathemahankal have a well established industrial units. Hence, sample has taken from these talukas, remaining talukas namely Tasgaon, Jath, Khanapur, Kadegaon, Atpadi except sugar industries other industrial units are less in number therefore, sample from those talukas are excluded.

As per database available in August 2007, the total number of industries in Sangli district was 3038. Its composed of 1% large scale industries (31), 0.6% medium scale industries (15) and 98.5% (2992) small scale industries, of which Sangli district has 6% red category industries, and 13% orange and 81% green industries. The present study gives emphasis on studying only red category industries (130) which are most polluting one, which stood at 17.

Its stratified sample was taken that includes 10% of the large scale industries 2 (23), 2 (14) medium scale industries and 13 (132) small scale industries.

Sampled Large Scale Industries

Sugar industries have played a pivotal role in industrial development of Sangli district. So far as sample of large scale industries taken is :

1. Vishwasrao Naik Co-operative Sugar Factory Ltd., Post Yashwantnagar, Tal. Shirala, Dist. Sangli.
2. Rajarambapu Patil Co-operative Sugar Factory Ltd., Post Sakharale, Tal. Walwa, Dist. Sangli

Sample of Medium Scale Industries

1. M/s Jolly Board Limited, A/p. Desing,
   Tal. Kavathemahankal, Dist. Sangli
2. M/s Sahyadri Starch Industries Ltd.,
   Plot No. A/6, 7, 8, MIDC, Miraj, Dist. Sangli

Sampled Small Scale Industries

Sample of 13 small industries is taken from Miraj and Palus talukas, among which 6 foundry industries are taken –

1. M/s Jason's Foundry Pvt. Ltd., Plot No. 13, MIDC Kupwad, Tal. Miraj, Dist. Sangli
2. M/s Jagdeesh Iron & Steel Pvt. Ltd., Plot No. D-23, MIDC Miraj, Dist. Sangli
3. M/S Veeresha Casting Pvt. Ltd., Plot No. J-101, MIDC Miraj, Dist. Sangli
4. M/s Vikrant Metal Industries, Plot No. 48, MIDC, Palus, Dist. Sangli.

5. M/s Barvepco Cast Alloys Pvt. Ltd., Plot No. A-2, MIDC Palus, Dist. Sangli
6. M/s Shree Kedar Metal Foundries, Plot No. 49, MIDC Palus, Dist. Sangli

Four Dairy Industries also have sampled from Miraj taluka. Those are –

1. M/s The Bombay Nagaroi Milks Co-operative Society Ltd., Plot No. 10, MIDC Miraj, Dist. Sangli
2. Ghanshyam Dairy Products Co., Plot No. W-10, MIDC Miraj, Dist. Sangli
3. M/s Hamma Dairy Pvt. Ltd., Plot No. D-48, MIDC Miraj, Tal. Miraj, Dist. Sangli
4. Ramvishwas Milk Products, S. No. 1010, Near Datta Mandir, Sangliwadi, Sangli.

Two Petro Chemical and 1 Pharmaceutical Industries are also takes as sample. Those are –

1. M/s Subhadra Petro Chemicals Pvt. Ltd., Plot No. F-2, MIDC Kupwad, Dist. Sangli
2. M/s Shree Petro Chem., Plot No. J-34, MIDC Kupwad Block, Dist. Sangli
3. Symbiosis Co-operative Pharmaceuticals Ltd., J-89, MIDC Kupwad Block, Dist. Sangli

An environmental auditing practices of above sampled industries is discussed in the following sub sections.

4.3 Environmental Audit : An Empirical Analysis of Large Scale Industries in Sangli District

In large scale industries, sugar industries have predominant place in the industrial development of Sangli district. Hence, a researcher in following two sub sections gives an empirical analysis of sugar industries environmental auditing.

4.3.1 Environmental Auditing of Vishwasrao Naik Co-operative Sugar Factory

Environmental auditing covers the items like water and raw material consumption, pollution discharge to environment per unit of output of the parameter specified in the consent, hazardous waste from pollution control facilities, solid waste from the process and pollution control facilities, impact of pollution abatement measures on conservation of natural resources and on cost of production.[2]

4.3.1.1 Water Consumption

The pattern of water consumption of sugar industries spelt into categories such as process, cooling, domestic etc. The Maharashtra Pollution Control Board has given following limits or norms to sugar industries relating to water consumption.

Processing	660 CMD
Industrial Cooling	100 CMD
Domestic	150 CMD

Against these norms, the actual water consumption of Vishwasrao Naik Co-operative Sugar Factory is shown in the following Table No. 4.3.1.1

Table No. 4.3.1.1

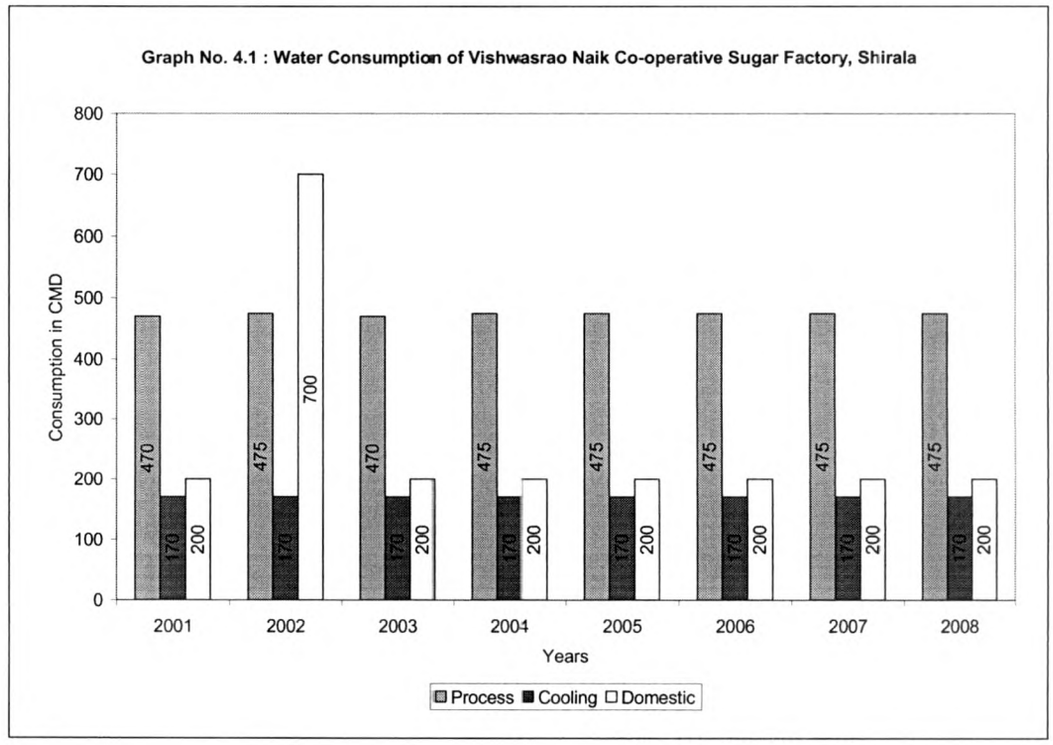
Water Consumption of Vishwasrao Naik Co-operative Sugar Factory, Shirala

(in CMD)

Year	Process	Cooling	Domestic	Total
2001	470 (55.45)	170 (20.23)	200 (23.80)	840 (100)
2002	475 (56.21)	170 (20.11)	700 (23.66)	845 (100)
2003	470 (55.95)	170 (20.23)	200 (23.80)	840 (100)
2004	475 (56.21)	170 (20.11)	200 (23.66)	845 (100)
2005	475 (56.21)	170 (20.11)	200 (23.66)	845 (100)
2006	475 (56.21)	170 (20.11)	200 (23.66)	845 (100)
2007	475 (56.21)	170 (20.11)	200 (23.66)	845 (100)
2008	475 (56.21)	170 (20.11)	200 (23.66)	845 (100)
CGR	0.12	0	0	0.07

Source : Environmental Statement Reports of Vishwasrao Naik Co-operative Sugar Factory, Shirala submitted to MPCB for financial years 2001-2008.

Note : Figures in the brackets shows the percentage to total.



The above table shows a categorywise water consumption of Vishwasrao Naik Co-operative Sugar Factory Ltd., Shirala during last 8 years period under study.

In 2001, for processing purpose industry has consumed 470 CMD, which slightly increased in 2008 to 475 CMD. The percentage share of process water consumption was 55.95%, which increased to 56.21% in 2008. During 8 years period water consumed in processing was increased by 0.12%. whereas for cooling purpose, industry has consumed 170 CMD water with percentage share of 20.23, which remained the same upto 2008. Domestic water consumption of industry was recorded at 200 CMD and its percentage share stood at 23.20%. These figures remained the same upto 2008. The total water consumption of industry was recorded at 840 CMD in 2001, which increased at 0.07 CGR and recorded at 845 CMD in 2008.

From the above table it is clear that sugar factory consumes 55% of its total water for processing purpose. It was also recorded that there was a perfect correlation between water consumed in process and total water consumption. The r value was recorded at 1.00.

The core part of our analysis is that to check whether industry has been using water in the limits of MPCB or not. From the above table it is shown that water consumed in process category was under the limits of the MPCB and also have a enough excess to reach that limit.

However, in the case of water used in industrial cooling it was higher than its upper limit given by MPCB. From the above table it is clear that industry has been using 170 CMD water for industrial cooling purposes, but it is more than 150 CMD that is maximum quantity given by the MPCB. It was also found that industry has been using more water quantity for domestic use and it reached to 200 CMD,

which was higher or excess than 150 CMD, which is the norm of the MPCB given to the industry.

Hence, it is much necessary that industry should reduce the consumption of water for cooling purpose and for domestic uses also.

4.3.1.2 Raw Material Consumption

As far as sugar industries are concerned, they largely depend on sugarcane for sugar production, bagasse, lime, orthophosphoric acid, sulpher, steam, grease & lubricants, costic soda are the other raw material used in the production of sugar.

Till today, MPCB or Central Pollution Control Board have not given any standardized limits of using raw materials in the production. They have given maximum quantity to produce, which is indirectly related to raw material consumption. The following table shows raw material consumption of Vishwasrao Naik Co-operative Sugar Factory Ltd., Shirala during the last 8 years period.

Table No. 4.3.1.2

Raw Material Consumption of Vishwasrao Naik Co-operative Sugar Factory Ltd., Shirala

(in Kg.)

Name of Raw Material	2001	2002	2003	2004	2005	2006	207	2008	CGR
Sugarcane	816.74	840.77	877.72	884.76	865.41	789.21	813.49	780.1	- 0.98
Bagasse	160.89	164.89	171.69	172.33	171.5	200.57	164.22	158.58	0.40
Lime	1.34	1.37	1.61	1.55	1.5	1.48	1.31	1.32	- 0.72
Ortho P. A.	0.007	0.006	0.017	0.009	0.007	0.011	0.88	0.8	96.6
Sulpher	0.42	0.41	0.47	0.55	0.45	0.38	0.43	0.41	- 0.91
Steam	353.96	362.93	360.68	384.88	350.3	348.23	361.27	360.62	- 0.10
Grease & Lubricants	0.031	0.037	0.042	0.044	0.035	0.044	3.11	3.51	92.86
Costic Soda	0.21	0.027	0.037	0.034	0.03	0.03	3.24	2.61	96.96

Source : Same as of Table No. 4.3.1.1

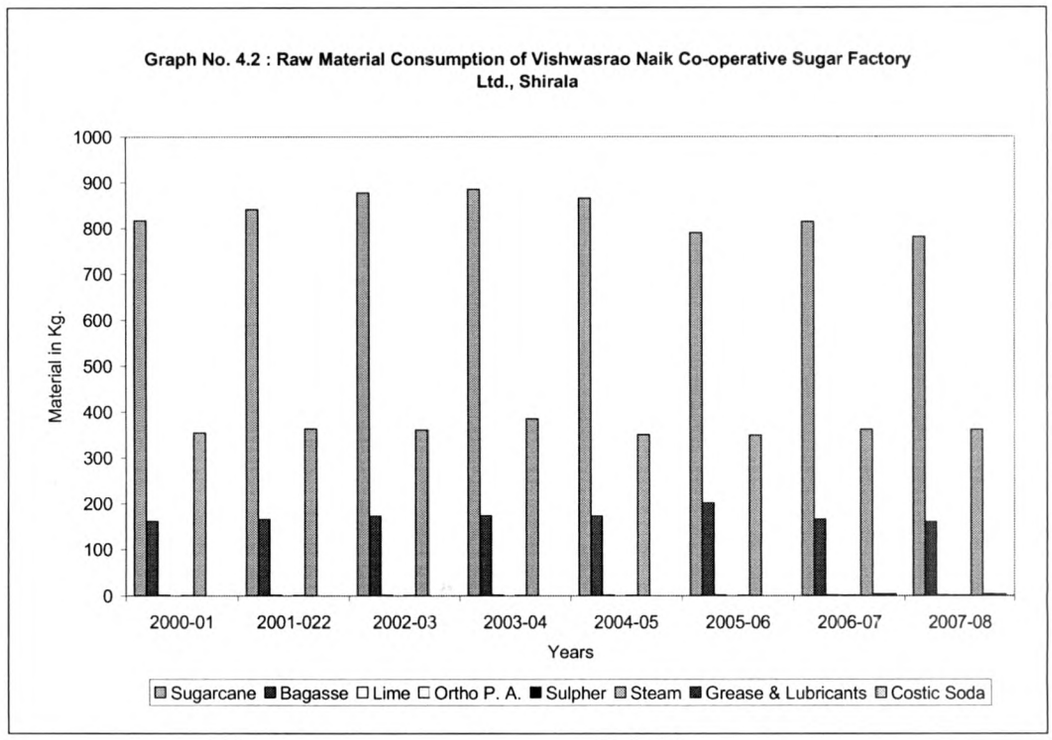


Table No. 4.3.1.2 shows that in 2001, this factory has used 816.74 kgs of sugarcane to produce 100 kgs of sugar. The ratio was seen to be decreased by CGR of 0.98% and recorded at 780.1 kgs of sugarcane to produce 100 kg of sugar. In the same way, factory has also reduced the consumption of lime, sulphur, steam by CGR of 0.72%, 0.95% and 0.10%. However, in the case of bagasse, ortho P.A., grease and lubricants and costic soda factory did not succeed in reducing their consumption. However, they have increased by CGR of 0.46%, 96.6%, 92.86% and 96.96%. This will show that consumption of such materials was increasing very fast.

4.3.1.3 Pollution Discharge to Environment

With taking an immense care, the country has setup the specific environmental standards for water, air, land and noise environments, to conserve environment and natural resources, the industry specific environmental standards have also been evolved to stop the environmental degradation.[3] They are as follows for large scale industries especially for sugar industries.

pH	5.5 to 9.0
Suspended solids	Not to exceed 200 mg/l
BOD	Not to exceed 100 mg/l
COD	Not to exceed 250 mg/l
Oil & Grease	Not to exceed 10 mg/l
Total Dissolved Solids	Not to exceed 2100 mg/l
Sulphate	Not to exceed 1000 mg/l
Chloride	Not to exceed 600 mg/l

Against these pollutants and their maximum standards, actual pollutants discharged by factory is shown in Table No. 4.3.1.3.

Table No. 4.3.1.3

Pollution Discharged to Environment by Vishwasrao Naik Co-operative Sugar Factory Ltd., Shirala

(in mg/L)

Untreated

Pollutant	2001-02	2003-04	2005-06	2007-08	CGR	
					Minimum	Maximum
pH	4.1-5.7	4.1-5.6	4-5.5	4.1-5.7	0.24	- 0.18
Suspended Solids	400-455	400-450	425-475	400-465	0.10	1.06
BOD	550-1620	550-1600	555-1665	550-1620	0.9	0.29
COD	1600-3620	1600-3600	1610-3580	1600-3620	0.06	-0.05
Oil & Grease	5-20	5-15	3-13	5-20	-4.97	-1.42
TDS	2100-3000	2100-2500	2250-3000	2100-3000	0.69	0.33
Sulphate	80-120	80-100	85-115	80-120	0.60	1.04
Chloride	70-100	70-90	70-95	70-110	0	3.45

Treated

Pollutant	2001-02	2003-04	2005-06	2007-08	CGR	
					Minimum	Maximum
pH	6.6-7.6	6.2-7.5	6.8-7.8	6.6-7.6	0.92	0.39
Suspended Solids	120-160	180-190	120-170	120-150	-3.97	-1.10
BOD	20-50	40-80	20-68	20-50	-6.69	-1.61
COD	120-210	200-220	120-220	120-220	-4.97	1.40
Oil & Grease	0-5	0-5	0-5	0-5	0	0
TDS	1100-1500	1100-1600	1100-1600	1100-1500	0	0
Sulphate	10-18	8-10	8-10	10-18	0	0
Chloride	70-90	70-90	70-90	70-90	0	0

Source : Same as of Table No. 4.3.1.1

From the above table to what extent factory was responsible for pollution is shown. There are two tables, which show quantity of various pollutants under untreated situations and after treatment situations.

1. pH

Under untreated conditions, the range value of pH was less which suggested that water was more acid mix of pollution and *after* treatment the range values are seen to be increased over the years. Minimum values increased by CGR of 0.92% and maximum values by CGR of 0.39%, which makes clear that factory has been trying to protect water quality.

2. Suspended Solids

Under treated situations, range values of suspended solids were very high. After treatment, the values and ranges were rapidly coming down and recorded at the range of 120-150 mg/L, which were at the range of 400-455 under untreated situations. After treatment, minimum values were reduced by negative CGR of 3.07% and maximum by 1.10%, which went upto 190. It means that this factory has become

successful in removing suspended solids from water and also in keeping the values within the standards of the MPCB.

3. Bio Oxygen Demand

Under untreated situations the range of Bio Oxygen Demand values was very high, that was in 2001-02, the range values of Bio Oxygen Demand under untreated situation was recorded at the range value of 550 to 1620 mg/l and minimum and maximum values were also increased by CGR of 0.09% and 0.39% during 8 years.

After treatment BOD values came down very rapidly. The range values of BOD were recorded at 20-50 mg/l in 2001-02, which were 550-1620 under untreated condition. It makes clear that this factory has become successful in removing BOD from water for minimum value, it was reduced in negative CGR of 6.69% and maximum it was reduced by negative CGR of 1.61%.

4. Chemical Oxygen Demand

Like, BOD the quantity of COD in per litre water was high. In the case of untreated situations, the range value of chemical oxygen demand was recorded at 1600-3200 mg/l and was seen decreased after treatment to 120-210 mg/l in 2001. Maximum value was increased by 1.40% recorded at 220 in 2008 mg/L. However, they also were in the prescribed limits of the MPCB.

5. Oil and Grease

The MPCB has given 10 mg/l as a maximum limit. However, under untreated situation it was higher or more than norms. In the case of treatment, this has seen to be in the limits of the MPCB.

6. Total Dissolved Solids (TDS)

Total dissolved solids are also high or more in water under untreated situations. However, in the case of treatment, they were slightly removed and recorded within the range of the MPCB limits.

7. Sulphate

Under untreated conditions, sulphate was recorded in the range of 80-120 mg/L, which reduced to the range of 10-18 mg/l and were under the limits of the MPCB.

8. Chlorides

In the case of chlorides, the range values were the same with some differences. That under untreated conditions, maximum values of chloride were increased by CGR of 3.45% over the years. However, these were in the permissible limits of the MPCB.

In short, from the above table it is clear that after giving or providing treatment factory has succeeded in controlling quantity of pollutants and also in keeping them within the limits of the MPCB. This should be recorded as the benefits of environmental auditing practices accepted by sugar the large scale industries.

4.3.1.4 Waste Water Quantity

Waste water is one more parameter of pollution discharge to the environment. The MPCB has given the maximum quantity of waste water 400 CMD, which really depend on crushing capacity. The following table shows waste water quantity generated by sugar factory under study period.

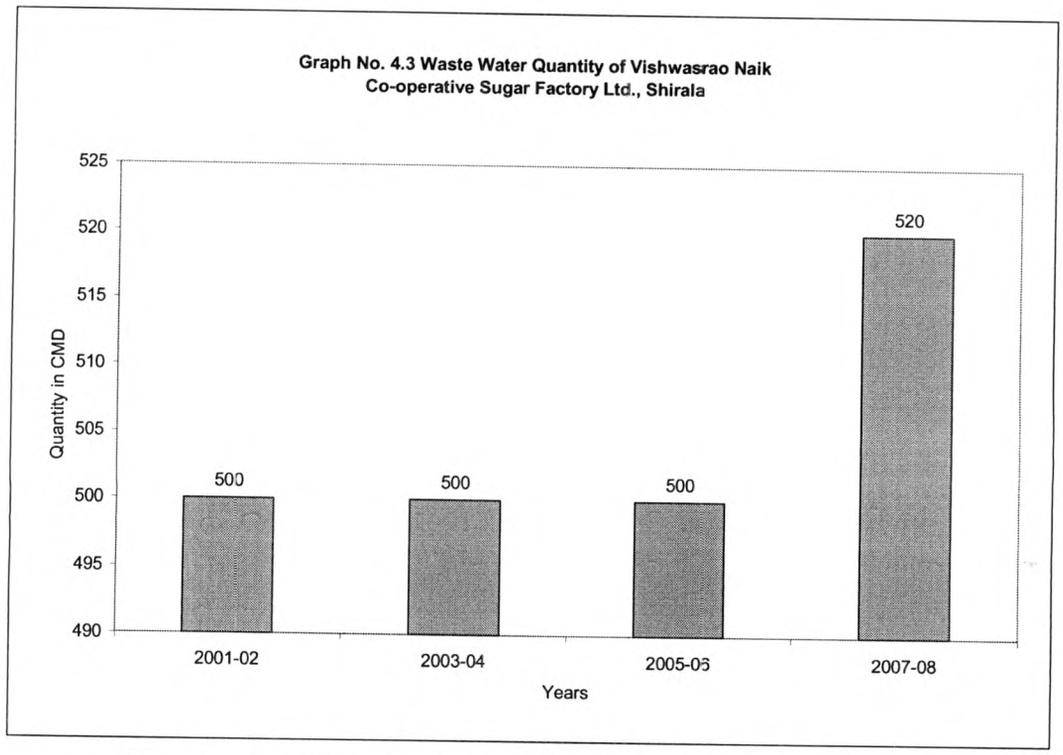
Table No. 4.3..1.4

Waste Water Quantity

(in CMD)

Year	Waste Water
2001-02	500
2003-04	500
2005-06	500
2007-08	520
CGR	1.18

Source : Same as of Table No. 4.3.1.1



The above table shows that in 2001-02, factory has generated 500 CMD waste water and seen that it increased in 2007-08 by CGR of 1.18% and went to 520 CMD.

From the above table it can be said that factory has been generating higher waste water quantity than the permitted quantity. Hence, it is much necessary that this factory should control waste water quantity.

4.3.1.5 Ambient Air Quality

Ambient air quality is an important aspect of pollution discharge to the environment. Parameters used in ambient air quality analysis, shows that whether industry is responsible for air pollution or industry is complaining against the norms. The consent given by the MPCB has given following standards for emissions of air pollutants.

1. SPM	180 mg/Nm^3
2. So_2	1920 Kg/day
3. No_x	30 mg/Nm^3

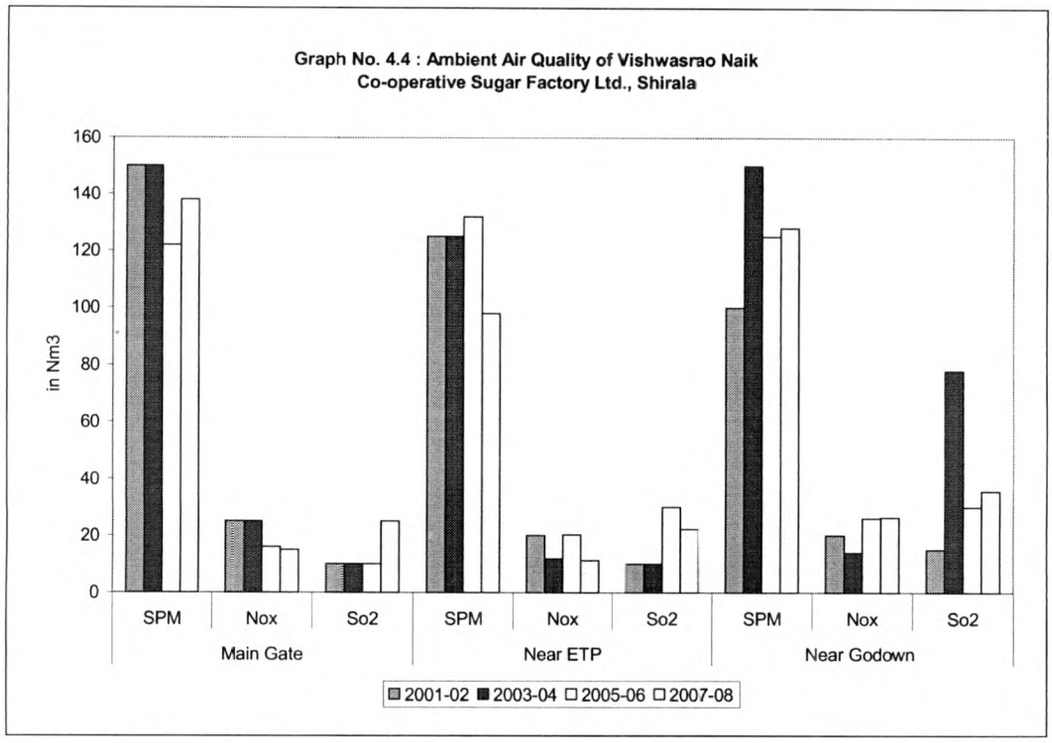
Against these norms, industries compliance is shown in the following table.

Table No. 4.3.1.5
Ambient Air Quality

(in Nm^3)

Year	Main Gate		
	SPM	No_x	So_2
2001-02	150	25	10
2003-04	150	25	10
2005-06	122	16	10
2007-08	138	15	25
CGR	-4.46	-17.95	31.63
Year	Near ETP		
	SPM	No_x	So_2
2001-02	125	20	10
2003-04	125	12	10
2005-06	132	20.2	30
2007-08	98	11.26	22.24
CGR	-6.53	-11.33	41.85
Year	Near Godown		
	SPM	No_x	So_2
2001-02	100	20	15
2003-04	150	14	78
2005-06	125	26	30
2007-08	128.1	26.36	35.62
CGR	5.76	15.57	30.52

Source : Same as of Table No. 4.3.1.1



Factory has carried out ambient air quality monitoring programme for twice in month to compliance against these standards at three different stations.

1. Station Main Gate

At main gate, in 2001-02 SPM was recorded at 150 mg/Nm^3, which decreased in 2007-08 to 138 mg/Nm^3. During the study period, factory has reduced SPM value by 4.46%. The So_2 recorded at 10, which increased by 31.63% and went upto 25 in 2007-08. Whereas No_x was negatively recorded at 17.65% which was 25 mg/Nm^3 in 2001-02 and reduced upto 14 mg/Nm^3 in 2007-08.

2. Near Effluent Treatment Plant

In 2001-02, SPM was recorded at 125 mg/Nm^3 that decreased by 6.53% upto 98 mg/Nm^3 in 2007-08. Likewise, No_x also reduced by 11.35% over the last 8 years. It was recorded at 20% in 2001-02 that decreased in 2007-08 and recorded at 11.26%. However, the values of So_2 recorded at 22.24. The growth rate observed during the year was 41.83%.

3. Near Godown

Near godown in 2001-02, the value of SPM was recorded at 100 and in 2007-08, it increased by 5.76% and reached at 128%. Likewise, the value of No_x was rose by 11.57%, which was earlier recorded at 20 in 2001-02 and increasingly recorded at 26.36%. The values of So_2 were also seen to be increased by 30.52% over the 8 years.

In short, as ambient air quality analysis was carried out one should say that factory has ensured 100% compliance against the standards. At the station of main gate factory succeeded in reducing SPM values and at the station of near ETP, the values of SPM and No_x were reduced. However, at station near godown all values had increasing trends. It is also found that there were less deviations in the values of No_x and So_2 whereas high deviation or more deviation was found in the values of SPM.

4.3.1.6 Stack Monitoring Analysis

Table No. 4.3.1.6

Stack Monitoring Analysis of Vishwasrao Naik Co-operative Sugar Factory Ltd., Shirala

Stack - I

Year	Stack Height (in meter)	Stack Diameter (in meter)	Boiler Type	Fuel	Boiler Make	Stack Material	Gas Velocity	F. G. Temperature	SPM mg/Nm^3	No_x ug/Nm^3	So_2 ug/Nm^3
2001-02	45	3	Horse Type	Bagasse	Thermax	MS	7.30	180	290	101	155
2003-04	45	3	Smoke Type	Bagasse	Thermax	MS	7.30	185	138	86	48
2005-06	45	3	Smoke Type	Bagasse	Thermax	MS	8	178	300	101	155
2007-08	45	3	Smoke Type	Bagasse	Thermax	MS	7.30	185	140	66	158
						CGR	- 0.91	0.49	-2.89	-10.55	13.08

Factory has a horse shape boiler with the 45 meter height and 3 meter diameter. Gas velocity was recorded at 730 m/sec which increased by CGR of 0.01% over the 8 years. Fuel gas temperature was recorded at 180^0C and it further increased to 185^0C with growth rate of 0.43% SPM was recorded at 290 mg/Nm^2 with decreasing growth rate of 2.89% during the 8 years. Likewise, No_x was also reduced by 10.55% whereas the concentration of So_2 was increased by 13.08% during the last 8 years.

4.3.1.7 Noise Pollution

Factory has carried out sound level measurement programme to compliance against the MPCB norms, that is sound should not exceed 75 dB during day and 70 dB during night mode. Against these standard actual sound levels are shown in following table.

Table No. 4.3.1.7
Sound Level in Factory

(in dB)

Sr. No.	Station	2001-02	2003-04	2005-06	2007-08	CGR	
						Min	Max
1	Mill House	82-84	84-85	84-85	85.2-85.3	0.07	0.46
2	Boiler House	78-94	80-98	81-85	78.1-82.4	0.12	- 5.23
3	Centrifugal Section	76-96	80-99	81-99	79.6-88.1	1.29	- 2.57
4	Laboratory	58-60	60-62	60-62	60.4-628	1.22	1.37

Source : Same as of Table No. 4.3.1.1

The above table shows, laboratory was the only station, where sound level was found in the range of 58 to 62, which was less than permissible limits. Moreover, other 4 stations, those were mill house, boiler house, centrifugal section where sound levels were higher than the permissible limit. Hence, it can be said that industry could not control noise levels during last 8 years. It was also found that there was an increasing trend in noise pollution. Therefore, it can be suggested that factory should control the sound levels.

4.3.1.8 Hazardous Waste

Factory has been generating hazardous waste from pollution control facilities and effluent treatment plant sludge. The Maharashtra Pollution Control Board has given standardized limits for ETP sludge that sludge should not exceed 50 MT/L and spent oil should not exceed 0.5 MT/L.

Based on these maximum limits, actual hazardous waste generated by factory is shown in following table.

Table No. 4.3.1.8

Hazardous Waste of Vishwasrao Naik Co-operative Sugar Factory, Shirala

Waste (in kg)	2001	2002	2003	2004	2005	2006	2007	2008	CGR
From Process	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
From PCF & ETP sludge	3900	3950	4000	5000	5000	6000	6000	5960	9.73
Waste Oil & Oil Emulsion	1250	1350	1400	1875	1880	1800	1800	1790	5.76

Source : Same as of Table No. 4.3.1.1

The above table shows that factory has not generated hazardous wastes from process, but from pollution control facilities and ETP sludge. This factory has generated 3900 kg. of hazardous waste in 2001, which increased by 7.75% and recorded at 5960 in 2008. One more source of hazardous waste was waste oil and oil emulsions. In 2001, this was recorded at 1250 kg and seen to be increased to 1800 kg in 2008. In this type of waste generation, CGR was recorded at 5.76%. Industry has been generating more hazardous waste than its permissible limits. Hence, it is much necessary that it should reduce the hazardous waste quantity and compliance against the MPCB norms.

4.3.1.9 Solid Waste

Factory has been generating solid wastes from process in which bagasse, press mud and ash are generated. Solid waste generated by such ways is shown in the next table.

Table No. 4.3.1.9

Solid Waste of Vishwasrao Naik Co-operative Sugar Factory, Shirala

(quantity in kg/year)

Solid Waste	Part D	2001	2002	2003	2004	2005	2006	2007	2008	CGR
From Process	Bagasse	101339	120286	67502.92	63139.96	63139	96920	125742	127253	3.51
	Press mud	13212	13905	8400.8	7763	7763	11963	16030	15858	3.69
	Ash	11815	2082	1160	1126	7126	1170	1125	1400	-17.47
From PCF & ETP Sludge	Bagasse	4800	4500	400	5000	5000	5000	6500	6500	5.66
	Press mud	13212	13905	8400.8	8400	7763	11903	16030	15858	3.60
	Ash	71707	81553	1000	1000	18067	7222	1300	6111	-29.26
Sold	Bagasse	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
	Press mud	2841627	30251.46	20000	20000	5060	20435	34349	27924	-32.51
	Ash	11815	2082	2082	2082	1126	1170	1225	1400	-17.47
Disposed	-	-	-	-	-	-	-	-	-	-

Source : Same as of Table No. 4.3.1.1

In the above table, in 2001 factory has generated 101339 kg of bagasse, which was increased by 127553 kg in 2008. The compound growth rate of bagasse generation was recorded at 3.51%. Press mud is the more form of solid waste generated from process. In 2001, 13212 kg of press mud was generated by the factory, which increased upto 15858 kg in 2008. The CGR was recorded at 3.69% in press mud generation.

Ash is the third form of solid waste in 2001, 4800 kg of ash was generated by factory, which rose to 6500 kg in 2008. It increased by CGR of 5.66% over the last 8 years. Factory has recycled the press mud, bagasse and was sold was disposed of on their own premises.

4.3.2 Environmental Auditing of Rajarambapu Co-operative Sugar Factory Ltd., Sakharale

Rajarambapu Co-operative Sugar Factory is another large scale sampled industry. Environmental auditing practices of Rajarambapu Sugar Factory has been discussed as below.

4.3.2.1 Water Consumption

The total water consumption of this sugar factory has been split up into process, cooling and domestic categories. The consent given by the Maharashtra Pollution Control Board to this factory by putting following standardized limits related to water consumption.

Processing	660 m^3/day
Cooling	900 m^3/day
Domestic	11000 m^3/day

Against these standardized limits, factory's compliance is discussed in following table.

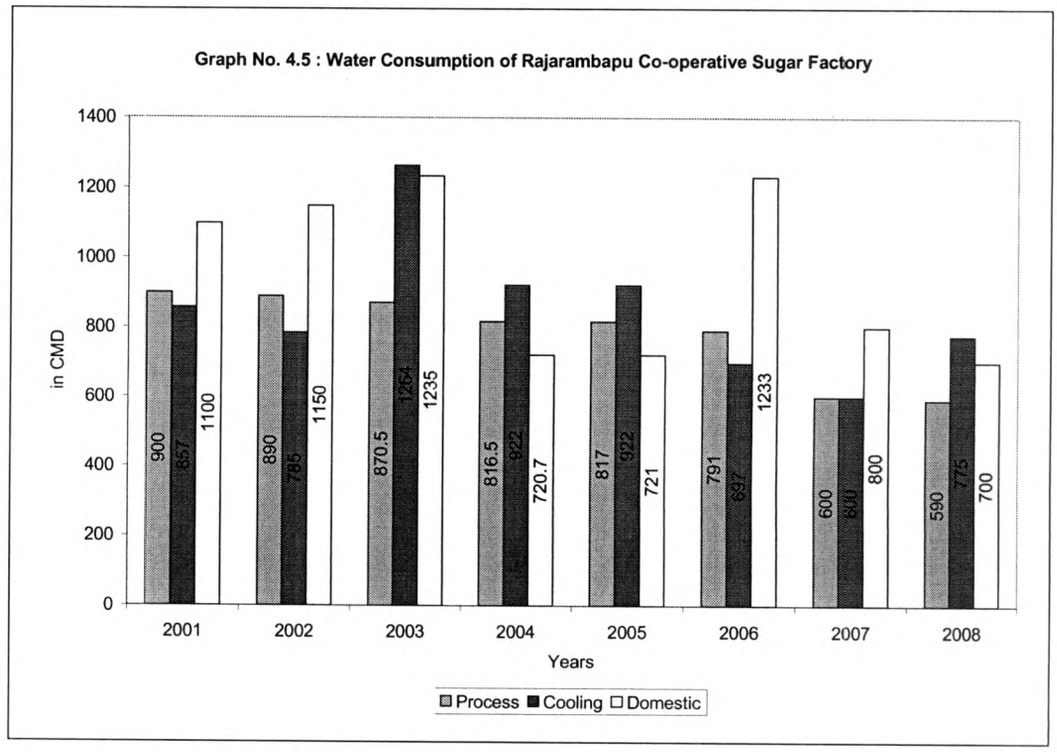
Table No. 4.3.2.1

Water Consumption of Rajarambapu Co-operative Sugar Factory

(in m^3/day)

Year	Process	Cooling	Domestic	Total
2001	900 (31.50)	857 (29.99)	1100 (38.9)	2857 (100)
2002	890 (31.50)	785 (27.78)	1150 (40.70)	2825 (100)
2003	870.5 (25.83)	1264 (37.5)	1235 (36.65)	3369.5 (100)
2004	816.5 (32.20)	922 (37.48)	720.7 (29.30)	2459.5 (100)
2005	817 (33.21)	922 (37.47)	721 (29.30)	2460 (100)
2006	791 (29.07)	697 (25.61)	1233 (45.31)	2721 (100)
2007	600 (30)	600 (30)	800 (40)	7000 (100)
2008	590 (25.57)	775 (37.53)	700 (33.41)	2065 (100)
CGR	- 6.018	- 4.46	- 8.3076	- 5.374

Source : Environmental Statement Reports of Rajarambapu Co-operative Sugar Factory, for the years 2001 to 2008



The above table gives details about the categorywise water consumption during the study period.

In 2001, factory has consumed 900 m^3/day water for processing purpose and its percentage share stood at 31.50%, which reduced to 590 m^3/day with percentage share of 25.57%. Water consumed for processing was reduced by 6.08%.

Cooling is one more category in which, factory has consumed 857 m^3/day in 2001, which decreasingly recorded at 775 m^3/day. Cooling water consumption was reduced by 4.48% over the study period.

Domestic water consumption was recorded at 1100 m^3/day and its percentage share stood at 38.50%, which fell by 5% in 2008 and remained at 33.41%, whereas as the water consumption for domestic purpose was reduced by 8.30% and recorded at 700 m^3/day.

The total water consumption of factory was at 2857 m^3/day in 2001, which reduced in 2008 to 2065 m^3/day. It is also clear that during the study period factory has reduced its total water consumption by 5.37%. There was also less standard deviation was found in water used for processing purpose.

Process water consumption and total water consumption had strong positive (r value .844) correlation was found. However, cooling water consumption, domestic water consumption with total water consumption were strong and positively correlated with r value of .820.

Regression technique also shows that there is dominance of domestic water consumption (beta value .542 and t value 4465.432) to the total water consumption.

4.3.2.2 Raw Material Consumption

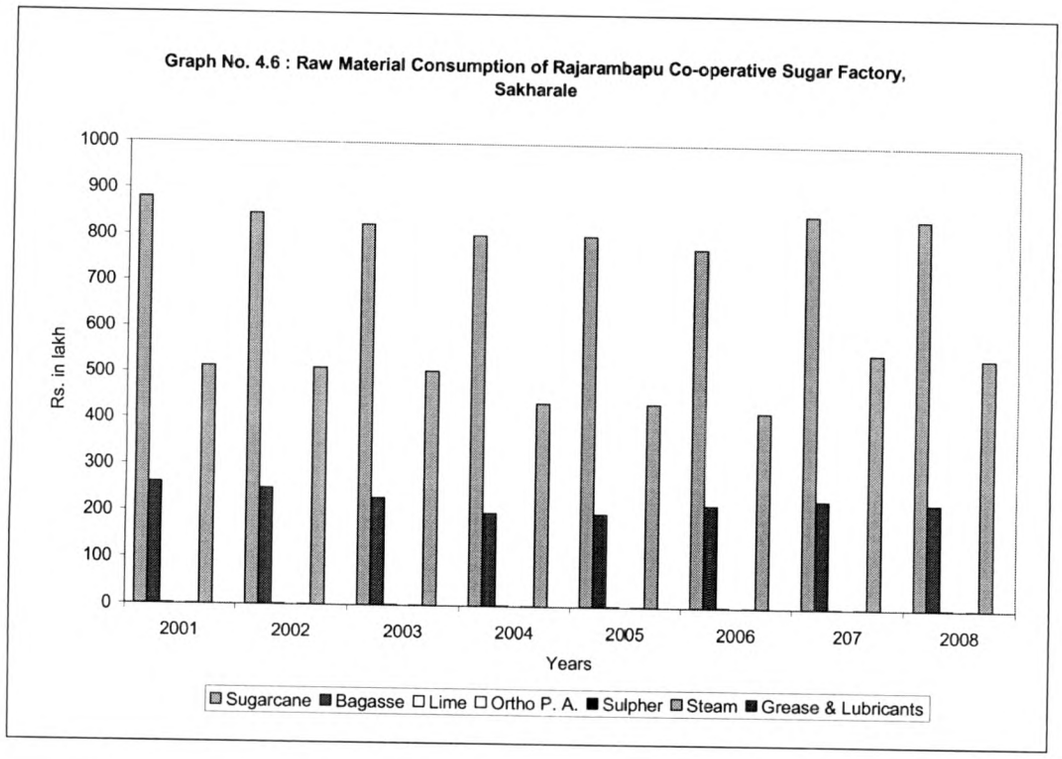
Along with sugarcane, bagasse, lime, ortho P. A., sulpher, steam, grease and lubricants are also important raw materials of sugar industries. The consumption of such raw materials is shown in the following table.

Table No. 4.3.2.2

Raw Material Consumption of Rajarambapu Co-operative Sugar Factory, Sakharale

Name of Raw Material	2001	2002	2003	2004	2005	2006	207	2008	
Sugarcane	880	845.53	823	801.66	801.66	775.24	850.95	841.95	-0.54
Bagasse	260.35	248.56	229.3	198.18	198.18	218.7	230.5	225.57	-17.98
Lime	1.456	1.52	1.47	1.5	1.5	1.45	.354	1.412	-1.01
Ortho P. A.	0.03154	0.0309	0.0284	0.0251	0.0251	0.0135	0.0312	0.0354	-2.82
Sulpher	0.45	0.475	0.406	0.556	0.556	0.417	0.45	0.478	0.27
Steam	512.8	510.03	504.47	436.01	436.01	418.95	548.75	540.75	0.21
Grease & Lubricants	0.07932	0.07793	0.07122	0.0567	0.0567	0.0771	0.07575	0.0698	-1.04

Source : Same as of Table No. 4.3.2.1



In the above table, factory has consumed 880 kg of sugarcane to produce 100 kg of sugar production, which decreased in 2008 and stood at 841.95 kg of sugarcane to produce 100 kg sugar. This ratio of sugarcane consumption declined by 0.54% over the 8 years of study period. Likewise the consumption of bagasse was 260.35 kg in 2001, that declined by 17.18% over the study period. In same way consumption of lime, ortho P. A. was also reduced by 1.0% and 2.82%, the consumption of grease and lubricants also reduced by 1.04% over the study period.

Above table also shows that the consumption of sulpher and steam increased over the period by CGR of 0.27% and 0.21%. In short, from the above table it is clear that factory has reduced consumption of mainly sugarcane, bagasse, lime ortho P. A. and grease and lubricants whereas consumption of sulpher and steam was increased. Industry should try to reduce the consumption of sulpher, steam also.

4.3.2.3 Pollution Discharge to the Environment

This is a most important aspect of environmental auditing practices. Therefore, it is explained in following sub sections.

A) Quantity of Water Pollutants Discharge to Environment

Now a days fresh water can not be used directly for drinking purpose due to contamination and pollution. Therefore, treatment is essential before it is used for drinking and also for industrial process.[4] The following table shows quantity of pollutant in water under untreated conditions and after treatment conditions.

Table No. 4.3.2.3 a
Pollution Discharged to Environment by Rajarambapu Co-operative Sugar Factory Ltd., Sakharale

(in mg/L)

Untreated

Pollutant	2001-02	2003-04	2005-06	2007-08	CGR	
					Minimum	Maximum
pH	4.9-6.7	4.4-5.8	4.3-5.9	4.1-5.3	5.42	-6.63
Suspended Solids	478-680	400-680	450-675	415-681	-3.01	-0.2
BOD	940-1485	850-1400	860-1350	825-1345	-3.72	-3.27
COD	1680-2700	1580-2600	1550-2550	1510-2520	-3.33	-2.23
Oil & Grease	5-20	5-15	5-18	5-20	1	1.83
TDS	1860-1980	1800-2600	1850-1950	1830-1950	-0.21	-3.27
Sulphate	80-110	99-110	85-105	75-100	-3.40	-3.26
Chloride	70-130	70-120	65-125	80-115	3.31	-3.21

Treated

Pollutant	2001-02	2003-04	2005-06	2007-08	CGR	
					Minimum	Maximum
pH	6-8-7.3	6.5-7.7	6.4-7.6	6.2-7.1	-2.88	-0.95
Suspended Solids	33-75	22-78	23-79	18-75	-20.94	0.12
BOD	25-85	30-68	32-67	26-67	-11.96	-7.02
COD	145-185	130-168	132-169	122-168	-4.90	-2.72
Oil & Grease	0-7	0-7	0-7	0-7	-	-
TDS	1120-1450	1100-1400	1170-1460	1120-1065	0.61	-8.45
Sulphate	90-110	90-110	93-109	90-110	0.32	-0.09
Chloride	70-120	70-120	73-125	62-130	-3.16	2.84

Source : Same as of Table No. 4.3.2.1

In Table No. 4.3.2.1, concentration of water pollutants is shown.

1. pH

Under untreated condition, pH values were found in the range of 4.1 to 5.8 for the study period of 8 years. After treatment range values for pH were recorded at 6.4 to 7.6 during the study period. It is observed that the range values were increased and come closer to the permissible range of 5.5 to 9. It means that after treatment factory has achieved necessary quantity of water by reducing acidity of water.

2. Suspended Solids

Under untreated conditions, the range values for suspended solids were found at 400-480 during the study period. After the treatment the range values were reduced in the range of 18 to 75 mg/L. Factory has been becoming successful in achieving permissible limits of suspended solids only after treatment.

3. Bio Oxygen Demand

The range values of BOD were recorded in the range of 825 to 1485 mg/l in untreated condition. After treatment the range values of BOD were recorded in the range of 25 to 67 mg/L.

4. Chemical Oxygen Demand

Like, BOD the range values of COD were also high in the untreated conditions. Under untreated conditions COD were recorded in the range of 1510 to 2700 mg/l. Moreover, after treatment these range values of COD distinguishly reduced and recorded in the range of 122-185 mg/L.

5. Oil and Grease

Under untreated condition, the range values of grease and oil pollutant were recorded in the range of 5 to 20 mg/l during the study period. Whereas as after treatment, the range value of this pollutant also seen to be reduced and recorded in the range of 0-7 mg/l.

6. Total Dissolved Solids (TDS)

Under untreated conditions, the range values of total dissolved solids were recorded in the range of 1800 to 2600 mg/l, which reduced after treatment and recorded in the range of 1100 to 1460 mg/l.

7. Chlorides

Under untreated conditions, the range values for chlorides were recorded in the range of 65 to 130 mg/l, which recorded in the same range with slight changes.

8. Sulphates

Under untreated conditions, the range values of sulphate were recorded in the range of 75 to 110 mg/l and remained in the same range after treatment also with slight changes.

In short, from the above table it can be said that the range values of various pollutants have been reducing after treatment except sulphate and chlorides. Under untreated situation the range values of pH, suspended solids, COD, BOD, oil and grease and total dissolved solids were much higher than permissible limits of the Maharashtra Pollution Control Board. However, after treatment the range values of above pollutants were reduced and found at permissible limits of the Maharashtra Pollution Control Board. It means that, this sugar factory has ensured compliance towards the MPCB norms after treatment only. This shows that it is much necessary for sugar industries that they should give treatment to ensure compliance.

4.3.2.3 b Ambient Air Quality

Ambient air quality analysis is auditing of pollution monitoring data forms one of the important aspects of the overall environmental audit of the industrial plant.[5] Hence, an effort has been made to give analysis of the concentration values SPM – Suspended Particulars Matter and gaseous pollutants such as So_2 and No_x in Table No. 4.3.2.3 b.

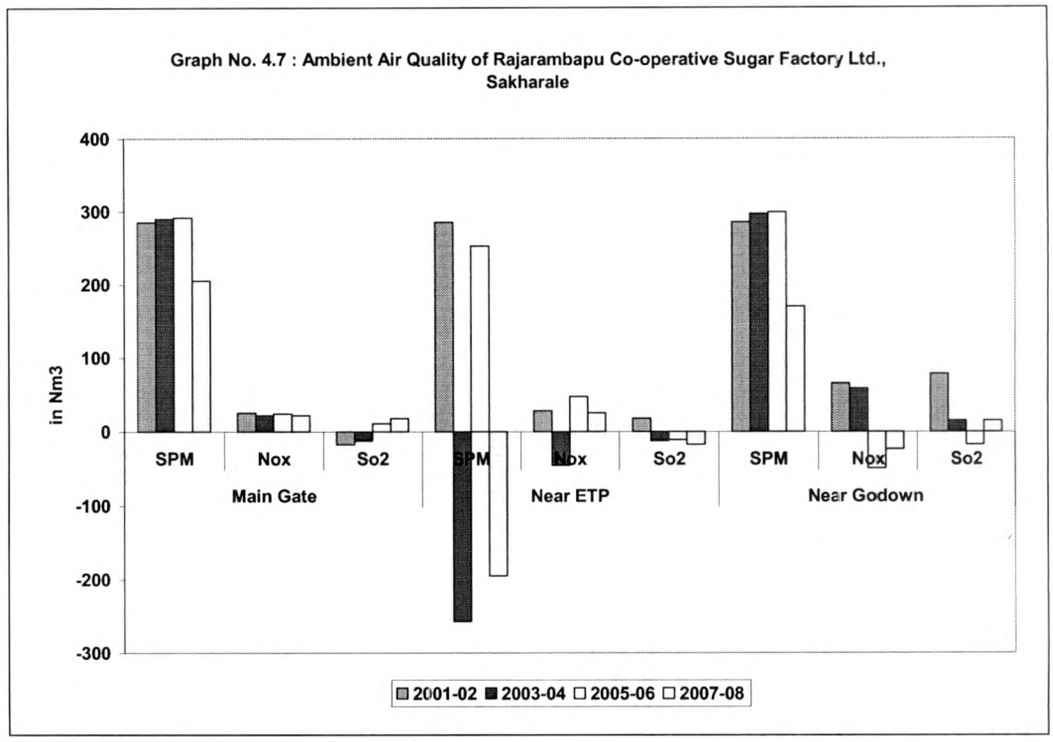
Table No. 4.3.2.3 b

Ambient Air Quality of Rajarambapu Co-operative Sugar Factory Ltd., Sakharale

(in Nm^3)

Year	Main Gate		
	SPM	No_x	So_2
2001-02	285	25	-17
2003-04	290	22	-12
2005-06	292	24	11
2007-08	205	22	18
CGR	-9.34	-3.76	0.84
Year	Near ETP		
	SPM	No_x	So_2
2001-02	285	28	18
2003-04	-257	-45	-12
2005-06	253	47	-11
2007-08	-195	25	-17
CGR	-10.90	-7.92	-2.55
Year	Near Godown		
	SPM	No_x	So_2
2001-02	285	65	78
2003-04	297	58	15
2005-06	299	-49	-17
2007-08	170	-23	15
CGR	-14.30	-28	-4.13

Source : Same as of Table No. 4.3.2.1



For ambient air quality, Maharashtra Pollution Control Board has given standards for SPM, that is 180 mg /Nm3 for large and medium scale industries. Against this standardized limit of MPCB, the actual concentration of SPM, So_2 and No_x as below.

1. Main Gate

At main gate, SPM was recorded at 285 mg/Nm^3 in 2001-02, which reduced upto 2007-08 at 205 mg/Nm^3. In this case SPM was declined by .34% during the study period. Even though it was reduced by 9.34% still it was excess than permissible quantity that is 180 mg/Nm^3 whereas gaseous pollutants were reduced No_x by 3.76% and So_2 by 0.84% during the 8 years period.

The maximum standard deviations were found for the concentration of SPM compared to No_x and So_2 at the main gate station.

2. Distillery Station

At this station, concentration of SPM was recorded at 285 mg/Nm^3 in 2001-02, which was declined upto 195 mg/Nm^3 in 2007-08. The concentration of SPM was reduced by 10.30% even though it was

reduced upto 195 mg/Nm^3. Still it was higher than permissible limits. Whereas concentration values of No_x and So_2 were reduced by 7.92% and 2.55%. At this station, high standard deviation were found in the concentration of SPM and comparatively less standard deviations were found in the concentration of No_x and So_2.

3. Station of Bridge

At the station of bridge, the concentration value of SPM was recorded at 285 mg/Nm^3, which reduced upto 170 mg/Nm^3 in 2007-08. The SPM concentration was reduced by 14.30% during the study period. In final year factory has become successful in keeping its SPM concentration value within the limit of MPCB that is 180 mg/Nm^3 whereas concentration of No_x and So_2 were reduced by 28% and 4.13%.

In short, from the above table it can be observed that this sugar factory has not became successful in keeping SPM concentration within the limits of MPCB except at the station of bridge and except year of 2007-08. Hence, it is suggested that it should reduce its SPM concentration at all stations and in future years.

4.3.2.3 c Waste Water Quantity

Waste water quantity generated by Rajarambapu Co-operative Sugar Factory is shown in following table.

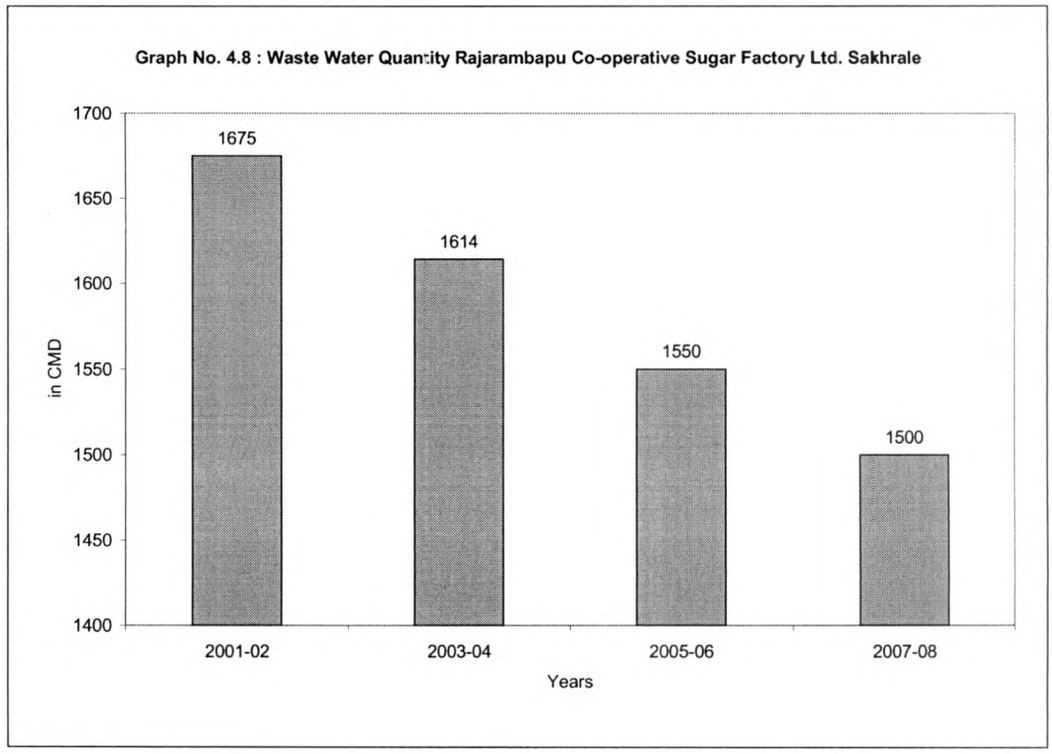
Table No. 4.3.2.3 c

Waste Water Quantity Rajarambapu Co-operative Sugar Factory Ltd. Sakhrale

(in CMD)

Year	Waste Water Quantity
2001-02	1675
2003-04	1614
2005-06	1550
2007-08	1500
CGR	3.64

Source : Same as of Table No. 4.3.2.1



For waste water generation MPCB has given 400 CMD as a maximum quantity. Against this permissible limit, in 2001-02 factory has 1675 CMD waste water, which reduced upto 1500 CMD in 2007-08. From the above table it can be said that factory has been wasting its water more than its permissible limit of MPCB. Hence, it is much necessary to reduce the waste water quantity and ensure compliance against permissible limit of MPCB.

4.3.2.3 d Stack Monitoring Analysis

For ensuring full compliance factory has conducted stack monitoring programme in two phases that is stack I and II. The stack monitoring analysis is given in following tables.

Table No. 4.3.2.3 d

Stack Monitoring Analysis of Rajarambapu Co-operative Sugar Factory Ltd., Sakharale

Stack - I

Year	Stack Height (in meter)	Stack Diameter (in meter)	Boiler Type	Fuel	Boiler Make	Stack Material	Gas Velocity	F. G. Temperature	SPM mg/Nm^3	No_x ug/Nm^3	So_2 ug/Nm^3
2001-02	32.0	30.49	Smoke Type	Bagasse	Thermax	RCC	-	145	150	65	155
2003-04	32.0	30.49	Smoke Type	Bagasse	Thermax	RCC	-	143	145	75	140
2005-06	32.0	30.49	Smoke Type	Bagasse	Thermax	RCC	-	144	130	85	135
2007-08	32.0	30.49	Smoke Type	Bagasse	Thermax	RCC	-	145	135	89	130
CGR	-	-	-	-	-	-	-	0.06	-4.16	11.27	-5.48

Stack - II

Year	Stack Height	Stack Diameter	Boiler Type	Fuel	Boiler Make	Stack Material	Gas Velocity	F. G. Temperature	SPM mg/Nm^3	No_x ug/Nm^3	So_2 ug/Nm^3
2001-02	30.49	3.048	Smoke Type	Bagasse	Thermax	MS	-	150	145	164	161
2003-04	30.49	3.048	Smoke Type	Bagasse	Thermax	MS	-	150	144	160	158
2005-06	30.49	3.048	Smoke Type	Bagasse	Thermax	MS	-	150	141	158	155
2007-08	30.49	3.048	Smoke Type	Bagasse	Thermax	MS	-	150	140	155	150
CGR	-	-	-	-	-	-	-	1	-1.25	-2.31	-2.28

Source : Same as of Table No. 4.3.2.1

Factory has installed two stacks of the height of 32 meter and 30 meter.

1. Stack I

Factory has installed one stack of 32 meter height and 3043 meter diameter. Factory has smoke type boiler in which bagasse is used for fuel. Fuel gas temperature was recorded at 145^0C and concentration of SPM was recorded at 150 mg/Nm^3, which decreased to 135 mg/Nm^3 in 2007-08. At Stack I SPM concentration was reduced by 4.16 likewise concentration of No_x was also increased by 11.27% during the study period, whereas concentration of So_2 was reduced by 5.48% in last 8 years.

2. Stack II

Factory has installed second stack at the height of 30 meter with 30 meter diameter. Likewise stack I boiler is smoke type and in which bagasse is used for fuel. Fuel gas temperature was recorded at 150^0C. The concentration value of SPM recorded at 145 mg/Nm^3 in 2001, which decreased at 140 mg/Nm^3 in 2008 that reduced by 1.25% the concentration of other pollutants that is No_x and So_2 also reduced by 2.39% and 2.28% during the study period.

4.3.2.5 Noise Pollution

The Maharashtra Pollution Control Board has given the norms related to noise. Those are sound level in factory should not be 75 dB in day and 70 dB in night mode. Against these norms the actual sound level are shown in the Table No. 4.3.2.5.

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Table No. 4.3.2.5

Sound Level in Factory

(in dB)

Sr. No.	Station	2001-02	2003-04	2005-06	2007-08	CGR	
						Min	Max
1	Mill House	70-75	80-87	74-80	67-74	-2.07	-1.23
2	Boiler House	72-76	82-90	70-74	70-75	-2.39	-2.32
3	Centrifugal Section	80-84	80-82	78-81	78-82	-1.07	0.84
4	Laboratory	66-68	60-62	62-64	56-62	-4.49	-2.42

Source : Same as of Table No. 4.3.2.1

The above table shows the sound levels at different stations during the study period at mill house. The sound levels were less than 75 dB for the year 2001-02 and for 2007-08, higher than 75 dB sound was recorded during the period 2003-04 to 2005-06. Likewise mill house at boiler house, sound level were also found high in the year 2003-04 except this year factory has become successful in keeping sound levels less than 75 dB. Central fuel station is a very important place at which sound level were always observed higher than 75 dB and finally at the laboratory station sound level was observed less than the 75 dB.

In short there was no consistency found whereas sound level kept at low than 75 dB. Factory should try to reduce the sound levels at the station of central fuel section where sound levels was observed higher than 75 dB, that is the permissible limits for sound levels in factory.

4.3.2.6 Hazardous Waste

Rajarambapu Patil Co-operative Sugar Factory has been generating hazardous waste from ETP sludge and oil waste and oil emulsion. The yearwise generation of above mentioned waste is shown in Table No. 4.3.2.6.

Table No. 4.3.2.6

Hazardous Waste of Rajarambapu Co-operative Sugar Factory Ltd., Sakharale

(Quantity in MT)

Waste (in kg)	2001	2002	2003	2004	2005	2006	2007	2008	CGR
From Process	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
From PCF & ETP sludge	135	133.5	98	110	110	130	120	105.87	- 1.63
Waste Oil & Oil Emulsion	8.5	9	6	7.5	7.5	8.5	9	8.2	0.94

Source : Same as of Table No. 4.3.2.1

In the above table, waste generation from pollution control facilities and ETP sludge was recorded at 135 MT in 2001, which fell to 105.87 MT in 2008. Factory has reduced hazardous waste by 1.63% during the study period, whereas waste oil and oil emulsions was increased over the years by CGR of 0.94%. In short, factory has been obeying environmental auditing norms and compliance against the MPCB norms.

4.3.2.7 Solid Waste

As far as sugar factory is concerned, factory has been generating solid waste. The sources of solid waste and its quantity and solid waste management is shown in the following table.

Table No. 4.3.2.7

Solid Waste of Rajarambapu Co-operative Sugar Factory Ltd., Sakharale

(quantity in Kg/year)

Solid Waste (in kg)	Part D	2001	2002	2003	2004	2005	2006	2007	2008	CGR
From Process	Bagasse	245698.5	232.689	121341	142049	178617	212317	222839	1254489	17.63
	Press mud	232.68	2365.89	21431	25468	24879	34385	36826.6	59945	51.71
	Ash	195	175	181	154	165	158	392	390	11.35
From PCF & ETP Sludge		100	95	98	110	105	130	120	114	3.49
Quantity Recycled										
	Press mud	28658	27265	25710	22635	23658	31356	36826.6	39825.4	5.43
	Bagasse	154897	1465592	121341	1391662	13568	211710	214588	229658	10.79
Sold	Press mud	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
	Bagasse	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Disposed	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil

Source : Same as of Table No. 4.3.2.1

In the above table, waste bagasse was recorded at 245698 kg in 2001, which increased in 2008 and recorded at 135448 kg. The overall increase of bagasse waste was at CGR of 17.63% during the study period. Likewise press mud is another type of solid waste. It was recorded at 232068 kg in 2001. Its overall increase of press mud waste was recorded at CGR of 51.71% during the study period. Ash is one more type of waste. Ash was recorded at 195 kg in 2001 that increased in 2008 to 390 kg. An ash generation was recorded increasingly at 11.35%. Whereas factory generates waste from pollution control facilities and ETP sludge was also recorded at 100 kg in 2001, which increased to 114 kg in 2008. This sludge was increased by CGR of 3.49% over the years.

Among the above mentioned quantity of waste, factory has been also engaging in recycling of certain waste quantity. Such recycled quantity of press mud was recorded at 28658 kg in 2001, which increased to 39825 kg in 2008. The compound growth rate for recycling quantity was recorded at 5.43% during the study period. Likewise bagasse also recycled into process. Recycling quantity of bagasse was recorded at 154897 kg in 2001 which increasingly seen at 229658 kg in 2008. The compound growth rate for recycling bagasse was recorded at 10.73% during the study period.

From the above table it is clear that factory has been generating solid waste, which has an increasing trend. Hence, it is suggested to reduce the waste rapidly and also to increase their recycling capacity and their quantity of bagasse and press mud, which will help to the factory to compliance against MPCB norms and regulations.

4.4 Environmental Auditing of Medium Scale Industries

As far as sampled medium scale industries are concerned, the researcher has made analysis of M/s Jolly Board Industries Pvt. Ltd., and Sahyadri Starch Industries Pvt. Ltd.

4.4.1 Environmental Auditing of M/s Jolly Board Industries Pvt. Ltd.

Environmental auditing practices can be described in following sub sections.

4.4.1.1 Water Consumption

Part B of the environmental statement report is about water consumption. Water consumed for its various activities or categories are recorded in this part. The consent to operate given by Maharashtra Pollution Control Board to M/s Jolly Board Industries regarding water consumption is prescribed below. The daily water consumption for the following categories is as under –

i)	Domestic	-	20.0 CMD
ii)	Industrial Processing	-	250.0 CMD
iii)	Industrial Cooling	-	Nil
iv)	Agriculture/Gardening	-	10.0 CMD[6]

The following table shows the actual water consumption of M/s Jolly Board Industries in last 8 years.

Table No. 4.4.1.1

Water Consumption

(in CMD)

Year	Process	Cooling	Domestic	Total
2001	30.489 (75.30)	-	10 (24.69)	40.489 (100)
2002	32.582 (73.08)	-	12 (26.91)	44.58 (100)
2003	32.62 (73.10)	-	12 (26.89)	44.62 (100)
2004	32.58 (73.08)	-	12 (26.91)	44.58 (100)
2005	32.6 (73.09)	-	12 (26.90)	44.6 (100)
2006	32.6 (73.09)	-	12 (26.90)	44.6 (100)
2007	32.62 (73.10)	-	12 (26.89)	44.62 (100)
2008	32.5 (73.03)	-	12 (26.96)	44.5 (100)
CGR	0.53	-	1.53	0.79

Source : Environmental Statement Reports of M/s Jolly Board Pvt. Ltd., for the years 2001 to 2008

Note : Figures in the brackets shows the percentage to total.

In 2001, industry has used 30.489 CMD water for process and 10 CMD water for domestic purpose. These figures are increasingly recorded at 32.5 CMD for processing and 12 CMD for domestic purposes. The water used for process was rose by 0.53% and water used for domestic purpose was increased by 1.53% during the 8 years period. The percentage share or water consumption for processing is recorded at 75.30% and 24.65% for domestic consumption. It is clear that industry has consumed maximum water for processing purposes. The total water consumption of industry in 2001 was about 40.489 CMD, which rose by CGR of 0.79% and recorded at 44.5 CMD in 2008.

There was a high degree and positive correlation between process and total water consumption was found with r value of .999.

4.4.1.2 Raw Material Consumption

As a manufacturers of hardboard M/s Jolly Board Industries mainly consumes bagasse, wood chips, wood logs.

Table No. 4.4.1.2 a

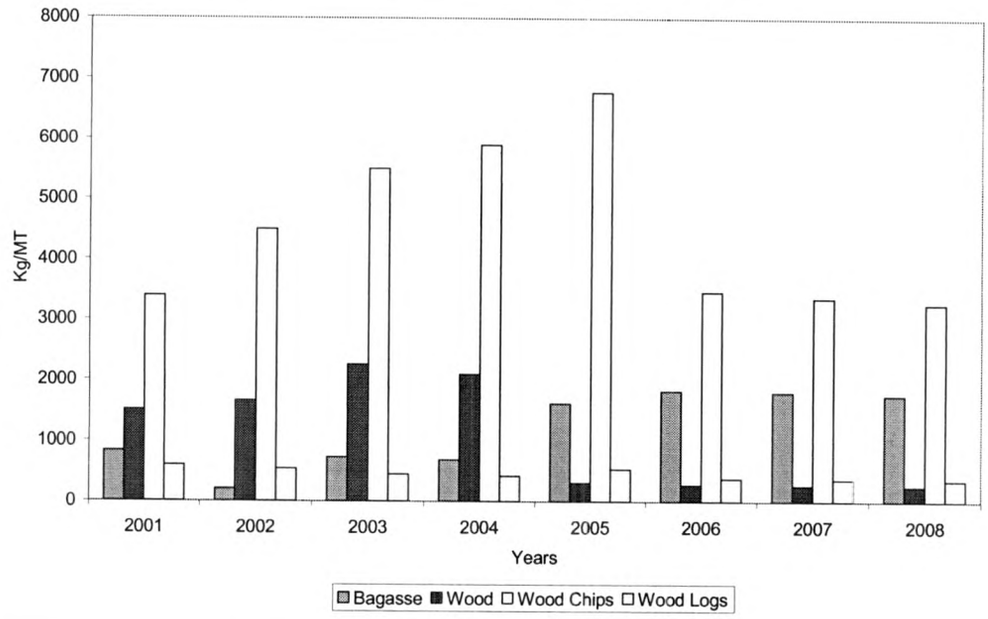
Raw Material Consumption of M/s Jolly Board Industries Pvt. Ltd.

(per unit of product out Kg/MT)

Year	Name of the Raw Material			
	Bagasse	Wood	Wood Chips	Wood Logs
2001	827	1500	3390	601
2002	208	1658	4500	540
2003	730	2250.31	5500	450
2004	682.85	2096	5900	418
2005	1612	305.2	6780	534
2006	1818	269.1	3455	383
2007	1800	260	3356	365
2008	1750	250	3261	349
CGR	-8.90	-30.11	-3.50	-1.81

Source : Same as of Table No. 4.4.1.1

Graph No. 4.9 : Raw Material Consumption of M/s Jolly Board Industries Pvt. Ltd.



The above table shows that bagasse wood chips, wood logs are important raw materials for producing hardboard. In 2001 industry has used 827 kg of bagasse, 1500 kg of wood, 3390 kg of wood chips and 605 kg of wood logs per metric tonne of hardboard. However, as per an environmental auditing practices are accepted by industry consumption of raw material decreased. The consumption of bagasse was reduced by 8.90% and recorded at 1750 kg/Mt in 2008. Likewise use of wood, wood chips, wood logs is reduced by 30.11%, 3.50% and 1.81% during the study period.

b) Fuel and Energy Consumption

Table No. 4.4.1.2 b

Fuel and Energy Consumption of Jolly Board Industries Pvt. Ltd.

Year	LDO (Lt./day)	Electricity (Kwh)
2001	-	530.68
2002	-	431.3
2003	-	408.69
2004	-	436.53
2005	-	392.3
2006	-	394.7
2007	-	394.0
2008	-	392.7
CGR	-	-3.25

Source : Same as of Table No. 4.4.1.1

One more table of fuel and energy consumption also shows that the industry has used 530.68 kwh of electricity per month in 2001, which seems to be decreasing in 2008 with 392.7 kwh of electricity per month. It is clear that industry has reduced fuel and energy consumption by 3.25% and this will be an advantage of environmental auditing practices accepted by M/s Jolly Board Industries over the 8 years.

4.4.1.3 Pollutants Discharge into the Environment

Part C of the environmental statement report contains information about pollutants discharge to the environment by any particular industry. This part broadly contain quantity of pollutants is generated by the industry.[7] The industry has to provide a comprehensive treatment system to achieve the quality of treated effluent to the following standards.

pH	5.5 to 9.0
Suspended solids	Not to exceed 200 mg/l
BOD	Not to exceed 100 mg/l
COD	Not to exceed 250 mg/l
Oil & Grease	Not to exceed 10 mg/l
Total Dissolved Solids	Not to exceed 2100 mg/l
Sulphate	Not to exceed 1000 mg/l
Chloride	Not to exceed 600 mg/l

The compliance of industry to above norms is shown in the following table.

Table No. 4.4.1.3

Pollution Discharged to Environment by M/s Jolly Board Industries Pvt. Ltd.

Untreated

(in mg/L)

Pollutant	2001-02	2003-04	2005-06	2007-08	CGR	
					Minimum	Maximum
pH	4.1-4.9	4.3-5.4	4.6-6.8	6.7 8.6	16.55	19.23
COD	5900-6800	6300-7000	6100-7400	6200-7000	1.72	1.43
BOD	2900-3550	3000-3300	3200-3650	3100-3500	2.68	0.58
Oil & Grease	Nil	Nil	Nil	Nil	Nil	Nil
TDS	1500-1750	1600-1900	1700-1820	1650-1725	0.58	-6.85
Suspended Solids	1650-4856	2000-4800	1800-5200	1776-6060	1.16	7.72
Chlorides	350-425	400-450	400-450	400-450	4.08	1.72
Sulphate	350-455	400-450	400-450	400-450	4.08	-0.33

Treated

Pollutant	2001-02	2003-04	2005-06	2007-08	CGR	
					Minimum	Maximum
pH	5.3-6.2	5.6-8.1	6.7-8.60	6.7-8.6	9.22	10.97
COD	45-82	200-250	50-92	35-65	1.63	-17.67
BOD	45-78	50-90	60-85	48-85	1.95	2.02
Oil & Grease	Nil	Nil	Nil	Nil	Nil	Nil
TDS	1500-1700	1600-1900	1700-1800	1500-1600	0.60	-2.33
Suspended Solids	58-69	60-90	60-85	56-78	-1.04	3.15
Chlorides	350-410	400-450	400-450	400-450	4.08	1.72
Sulphate	350-455	400-450	400-450	400-450	4.08	-0.33

Source : Same as of Table No. 4.4.1.1

The above table shows the various pollutants discharged into the environment during 8 years period.

1. pH

pH is a measure of alkanity or acidity of the given water sample. Under untreated situation pH is recorded in the range of 4.1 to 4.9. It means that acidity is high in sampled water and well seen to be reduced and reached at 5.3 to 6.2 that is neutral value for pH.

2. COD

Chemical Oxygen Demand is one of the most important parameters in water quality assessment and reflects the physical and biological process prevailing in water. Therefore, it is necessary to measure the dissolved oxygen of water. Under untreated situations COD was measured in the range of 5900-6800 mg/l in 2001 and the range value increased upto 6200 to 7000 in 2008. The CGR of maximum values was recorded at 1.72% and for minimum it was 1.93%. After treatment chemicals from water were removed very rapidly and range value recorded at 45 to 82 mg/l in 2001-02 and the range value for decreased upto 35 to 65 mg/l in 2008. The minimum values rose by 1.63% whereas maximum values fell by 17.67%.

3. BOD

In 2001 under untreated situations the range value for BOD were recorded in the range of 2900-3550 mg/l and for 2007-08 it is seen that the range values have increased to 3100 to 3500. The maximum values increased by 2.68 and minimum values by only 0.58%. After treatment BOD's range value were recorded in the range of 45 to 76 mg/l and slightly raised upto 48 to 85 mg/l in 2007-08. The minimum values rose by 1.95% and maximum values by 2.02%.

4. Total Dissolved Solids

In natural water the dissolved solids consists mainly of carbonates, bicarbonates, sulphates, chlorides, nitrates. Therefore, it requires efficient treatment to reduce and control the TDS from the effluent waste water. Under untreated situation, TDS were recorded in the range of 1500 to 1750 mg/l in 2001-02 and the range values were increased upto 1650 to 17725 mg/l in 2007-08. The minimum values were increased by 0.58% and the maximum values by 0.85%. After treatment the range values for TDS were recorded at 1500 to 1600 in 2007-08. In this case maximum values increased by 2.33% and minimum values increased by 0.6%. It makes clear that environmental auditing practices help to industry in reducing and controlling of TDS which is a sign of efficient treatment.

5. Suspended Solids

Under untreated conditions, the range values of suspended solids were very high, which recorded in the range of 1650 to 4856 mg/l in 2001-02 and increasingly recorded in the range of 1776 to 6560 mg/L. In this case CGR for minimum values were recorded 1.16% and for maximum values it was 7.72%. It makes clear that there was an increasing trend in suspended solids over the years. After treatment the range values were recorded at 58 to 69 mg/l in 2001-02, which were 56 to 78 in 2007-08. In this case minimum values decreased by 1.04 and maximum values increased by 3.15%.

6. Chlorides

The range value of the chlorides and sulphates were remained the same for the situation. The minimum values of these pollutant were increased by 4.08% and maximum values increased by 172.

The minimum value of sulphate increased by 4.08% but maximum values decreased by 0.35%. In short, untreated values of all pollutants and their growth rates for minimum values and maximum values were very high. However, after treatment the range of such pollutants declined partly and growth rates for minimum and maximum values also sharply declined. It reveals that M/s Jolly Board has attempted to environmental auditing rules and guidelines and for 100% compliance to control environmental pollution.

4.4.1.4 Waste Water Quality

Measurement of waste water quantity is one of the aspects of resource conservation. Hence, environmental auditing practices ensure to measure the waste water quantity. As per consent granted to Jolly Board by MPCB is concerned, it has fixed maximum quantity of waste water and that is 28.8 m^3/day. The following table shows actual waste water quantity of Jolly Board Industries.

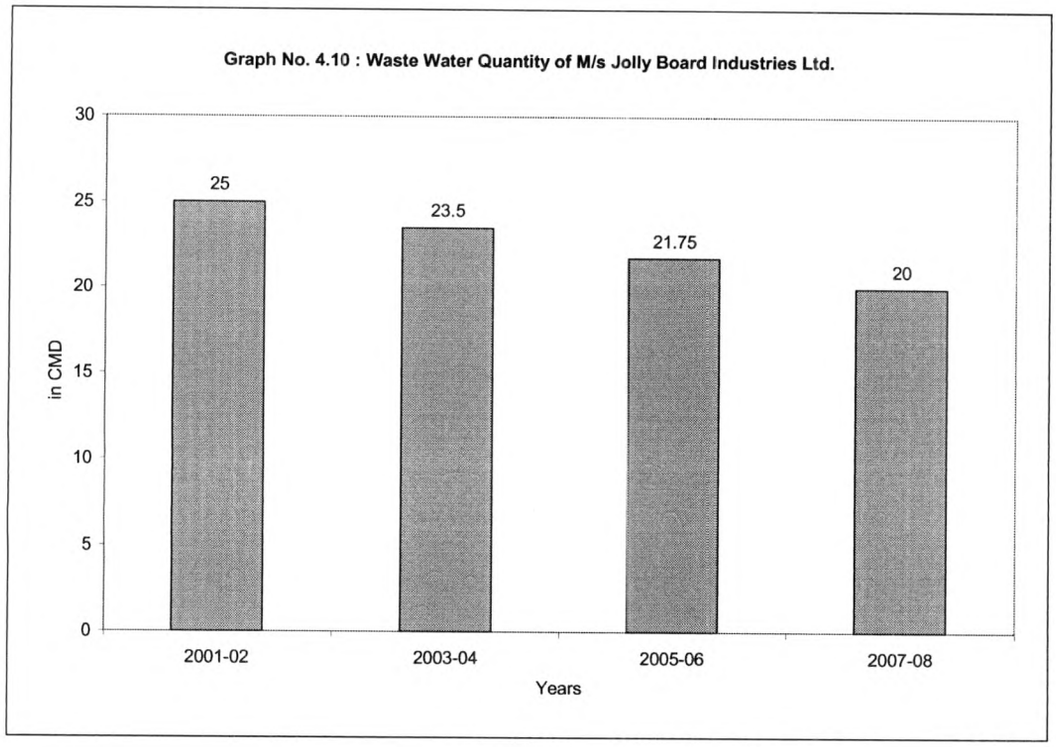
Table No. 4.4.1.3 b

Waste Water Quantity of M/s Jolly Board Industries Ltd.

(m^3/day)

Year	Waste Water
2001-02	25
2003-04	23.5
2005-06	21.75
2007-08	20
CGR	-7.19

Source : Same as of Table No. 4.4.1.1



The above table shows that, in 2001-02 industry had waste water of 25 m^3/day and it decreasingly recorded in 2007-08 at 20 m^3/day. It makes clear that industry has reduced its waste water quantity and has compliance against consent order.

4.4.1.3 c Ambient Air Quality

Ambient air quality (AAQ) is one more aspect of pollution discharge to the environment. As per consent order, the MPCB has given standards for emissions of air pollutants. Those are –

SPM/TPM - Not to exceed 150 mg/Nm^3

So_2 - Not to exceed 1280 kg/day

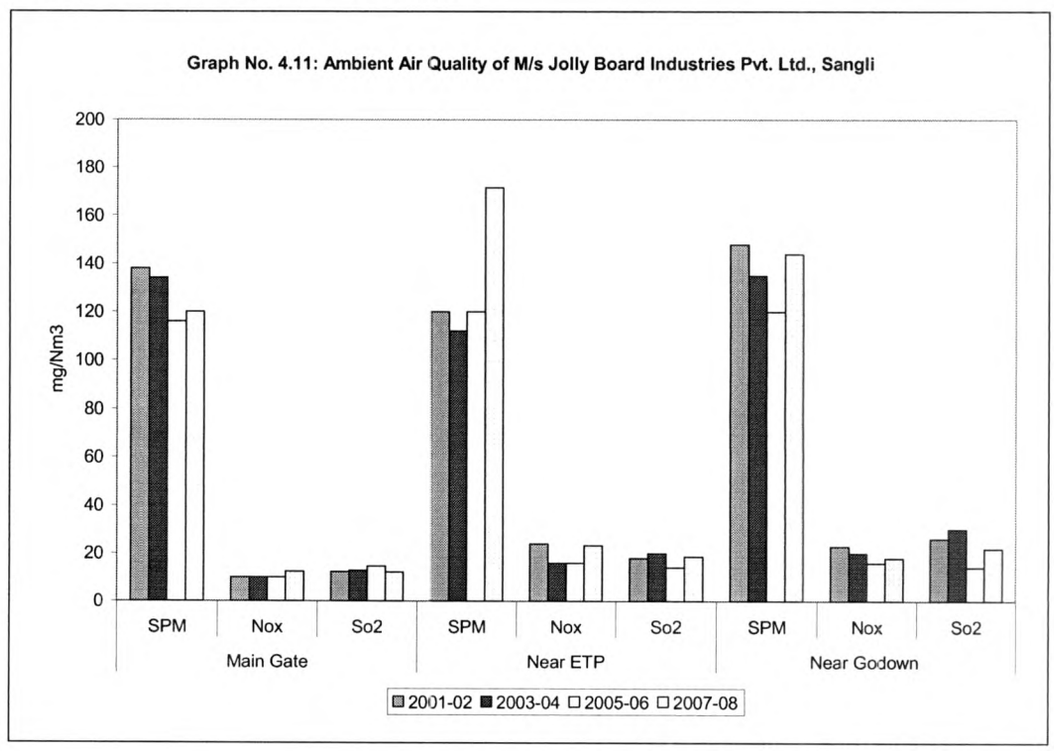
The table No. 4.4.1.3 c helps us to make analysis of ambient air quality.

Table No. 4.4.1.3 c
Ambient Air Quality

(in mg/Nm^3)

Year	Main Gate		
	SPM	No_x	So_2
2001-02	138	10	12.2
2003-04	134	10	12.84
2005-06	116	10	14.6
2007-08	120	12.48	12.1
CGR	-5.47	6.87	1.04
Year	Near ETP		
	SPM	No_x	So_2
2001-02	120	24	18
2003-04	112	16	20
2005-06	120	16	14
2007-08	171.50	23.30	18.60
CGR	1.06	-6.29	-2.54
Year	Near Godown		
	SPM	No_x	So_2
2001-02	148	23	26
2003-04	135	20	30
2005-06	120.0	16	14
2007-08	144.00	18.00	22.00
CGR	-1.97	-9.14	-11.86

Source : Same as of Table No. 4.4.1.1



Industry has carried out ambient air quality analysis for following three places.

1. Main Gate

In 2001-02 SPM was 138 mg/Nm^3 and it decreased in 2007-08 to 120 mg/Nm^3 by 5.47%. However, the values of No_x and So_2 were 10 and 12.2 mg/Nm^3 in 2001-02, which increasingly recorded at 12.48 mg/Nm^3 and 12.1 mg/Nm^3 by 6.87% and 1.04% growth rates. Standard deviation of SPM is about 10.64, which is higher than No_x and So_2.

2. Near ETP

For carrying out analysis of ambient air quality ETP is a very sensitive place. In 2001-02 SPM value was recorded at 120 mg/Nm^3 and further slightly increased in 2007-08 to 121.54 mg/Nm^3. This value increased by 1.06% whereas other pollutants such as No_x and So_2 were 24 mg/Nm^3 and 18 mg/Nm^3. In 2001-02 which fell to 23.30 mg/Nm^3 and 18.60 mg/Nm^3 in 2007-08. These were reduced by 5.24% and 2.84%. It makes clear that except SPM industry has become successful in reducing the values of No_x and So_2 near ETP station and less standard deviation found in values of So_2.

3. Near Boiler

Boiler is another sensitive place where carrying out an air quality analysis is always difficult. In 2001 SPM was recorded at 148 mg/Nm^3 and for 2007-08 it fell to 144 mg/Nm^3, it has fallen by 1.94% No_x and So_2 were recorded at 23 and 76 mg/Nm^3 in 2001 and further it also recorded at fall rate of 9.14% and 11.85% fall at the 18 mg/Nm^3 in 2007-08.

In short, even though it is difficult task to reducing the air pollution near the boiler. Industry has succeeded 100% and also reduced the air pollution. Whole analysis of AAQ also shows that No_x has minimum and standard deviation whereas SPM has more standard deviation.

4.4.1.3 d Stack Monitoring Analysis

Table No. 4.4.1.3 d

Stack Monitoring Analysis

Stack I

Year	Stack Height (in meter)	Stack Diameter (in meter)	Boiler Type	Fuel	Boiler Make	Stack Material	Gas Velocity	F. G. Temperature	SPM mg/Nm^3	No_x ug/Nm^3	So_2 ug/Nm^3
2001-02	30.5	0.66	Smoke Type	Bagasse	Thermax	MS	3.0	184	148	23	26
2003-04	30.5	0.66	Smoke Type	Bagasse	Thermax	MS	3.0	182	135	20	30
2005-06	30.5	0.66	Smoke Type	Bagasse	Thermax	MS	3.0	181	120	16	14
2007-08	30.5	0.66	Smoke Type	Bagasse	Thermax	MS	3.0	179	144	18	22
CGR	-	-	-	-	-	-	0	-0.87	-1.97	-2.14	-11.86

Source : Same as of Table No. 4.4.1.1

Industry has smoke type boiler with 30 meter height and 1.30 diameter. Gas velocity is recorded at 3 meter per second. Industry has erected the chimney with the specification given in consent order. Fuel gas temperature was recorded in 2001-02 at 184^0C, which stood at 129^0C in 2007-08 by fallen rate of 0.87. This will make clear that industry has become successful in reducing fuel gas temperature during 8 years.

4.4.1.4 Noise Pollution

M/s Jolly Board Industries has carried out sound levels measurement during the season's period after every 6 month. Maharashtra Pollution Control Board has given following norms related to noise pollution and sound levels is that as to maintain AAQ standards in respect of noise to less than 75 dB during day time and 70 dB during night time. In pursuing these standards industry has made noise measurement at five different stations. Those values are shown in following table.

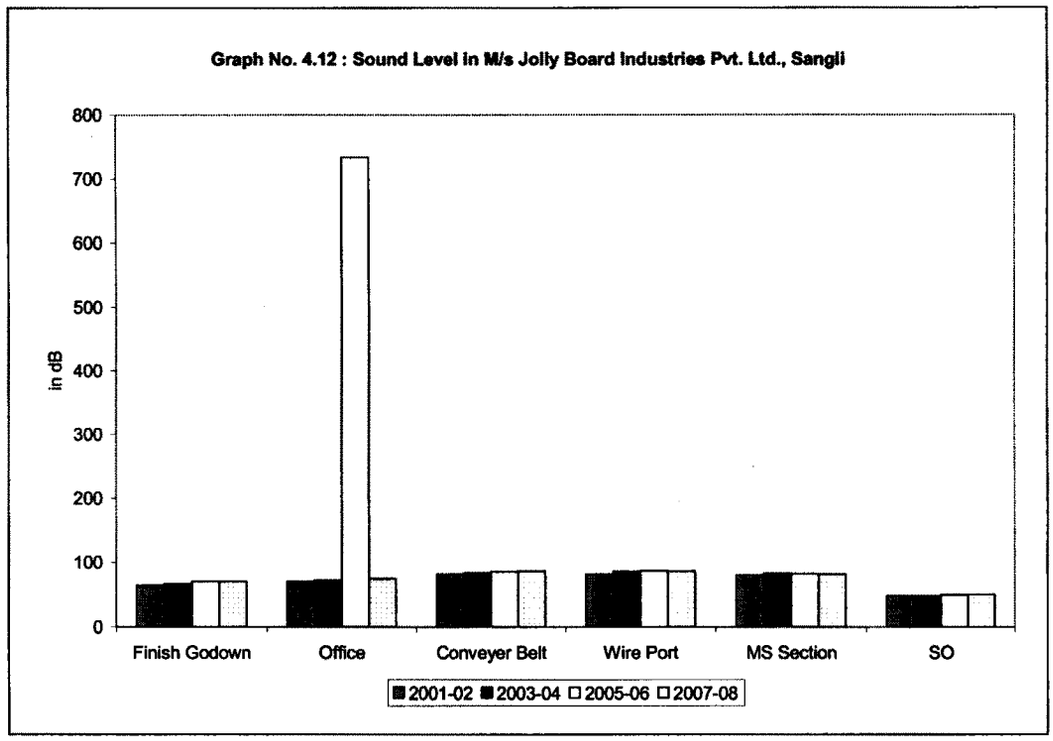
Table No. 4.4.1.4

Sound Level in Factory

(in dB)

Sr. No.	Station	2001-02	2003-04	2005-06	2007-08	CGR
1	Finish Godown	64	66	70.2	70.5	3.58
2	Office	70	72	734	73.9	1.83
3	Conveyer Belt	81	83.2	85.62	86.1	2.41
4	Wire Port	82	85.8	86.4	85.9	5.38
5	MS Section	80	83.0	82.6	81.7	0.58
6	SO	48	48.0	49.5	49.9	1.43

Source : Same as of Table No. 4.4.1.1



The above table shows that noise levels of finishing godown, officers and 50 meters away from factory are 3 stations where sound levels were less than MPCB norms, and converter belt, wire port and MS section are 3 stations at which industry failed to control the sound levels. It is also clear that out of 6 stations, industry has failed to control the sound levels at 3 stations, means that industry has got success in 50% noise control over the years.

4.4.1.5 Solid Waste

The MPCB has given parameters and its maximum quantity to industry those are –

i) Cutting of hardboard - 100 MT/M

ii) ETP Sludge - 5 SMT/M

Compared to these maximum quantity the following table shows the actual solid waste generated by the industry.

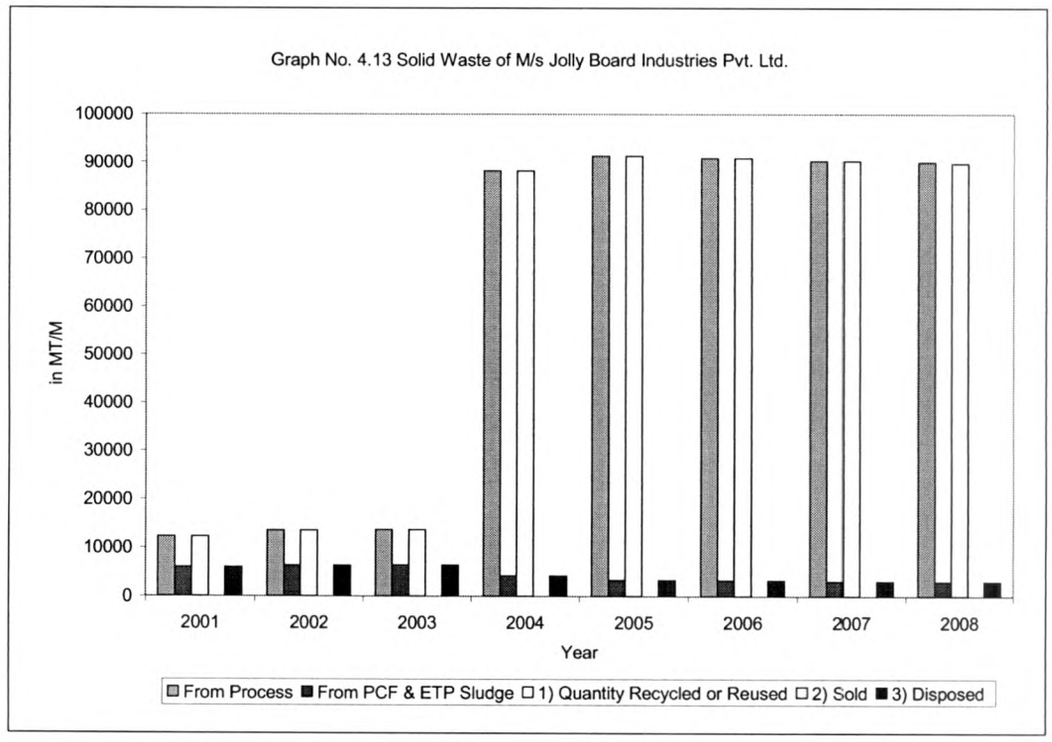
Table No. 4.4.1.5

Solid Waste of M/s Jolly Board Industries Pvt. Ltd.

(quantity in MT/M)

Solid Waste (in kg)	2001	2002	2003	2004	2005	2006	2007	2008	CGR
From Process	12250	13458.50	13581.56	88153.5	91270.42	90800	90287.6	89968.8	41.58
From PCF & ETP Sludge	5940	6250	6385	4148	3318.92	3240.8	3042.1	2945.9	-12.03
1) Quantity Recycled or Reused	12250	13458	13581.56	88153.5	91270.42	90800	90287.6	89698.8	41.58
2) Sold	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
3) Disposed	5940	6250	6385	4148	3318.92	3240.8	3042.1	2945	12.03

Source : Same as of Table No. 4.4.1.1



In 2001 from process that is from cutting of hardboard industry has generated 12250 MT solid waste which seen to be increased by 41.88% in 2008 to 89968 MT. However, it was reused in factory for manufacturing hardboard. One more parameter is that ETP sludge. In 2001 industry has generated 5940 MT and further it seems reduced in 2008 by 12.63% and reached at 2945.9 MT. It makes clear that industry has failed to maintain solid waste quantity, it particularly has succeeded in case of ETP sludge only.

4.4.2 Environmental Auditing of Sahyadri Starch Industries Pvt. Ltd.

Environmental auditing practices of Sahyadri Starch basically involves water and raw material consumption, pollution discharge to environment, ambient air and noise quality analysis and solid waste also.

4.4.2.1 Water Consumption

M/s Sahyadri Starch is a manufacturer of starch and liquid glucose. It needs water to process, the maize starch and allied activities. The Maharashtra Pollution Control Board has given following norms related to water consumption.

Industrial - 930 m^3

Domestic - 20 m^3

On this maximum limits water consumption of Sahyadri Starch is given in the Table No. 4.4.2.1.

Table No. 4.4.2.1

4.4.3 Water Consumption of Sahyadri Starch Industries Pvt. Ltd.

(m^3/day)

Year	Process	Cooling	Domestic	Total
2001	440 72.13	160 26.22	10 1.63	610
2002	500 74.62	160 23.88	101 1.49	670
2003	480 71.11	180 26.66	15 2.22	675
2004	500 71.42	190 27.14	10 1.42	700
2005	485 72.38	175 26.11	10 1.49	670
2006	490 72.05	180 26.47	10 1.47	680
2007	495 71.22	180 25.89	70 2.87	695
2008	500 62.89	270 33.96	25 3.14	795
CGR	4.65	5.088	10.86	2.42

Source : Environmental Statement Reports of Sahyadri Starch Industries, for the years 2001 to 2008

The above table shows the categorywise water consumption of Sahyadri Starch in which industrial water consumption includes water consumed for processes and cooling purpose. In 2001 industry

had consumed 440 m^3 for process and 160 m^3/day for cooling purposes in summation it consumed 600 m^3/day water for industrial purposes and the percentage share of water used in process was 72.13% and 26.72% for cooling purpose was jointly accounted for 98.35% and remaining 1.63% water was used for domestic purpose. The total water consumed in 2001 was recorded at 610, which increased in 2008 by 2.42% and went upto 795 m^3/day. The water consumed in process was recorded at 500 m^3/day with percentage share of 62.89%, which was less than 2001 by 10%. Water consumed in cooling purpose was also increased, which recorded at 2.70. The water consumption for process and cooling purposes has increased by 4.65% and 5.08%, whereas water used in domestic purpose is also increased by 10.84% and recorded at 25 m^3/day with percentage share of 3.14%.

The above table clearly shows that the industry has been consuming water at increasing rate, but the use of water was in limits of MPCB and it has excess of water to consume for industrial purpose.

There are less standard deviations found in water consumed for domestic purpose and more or high standard deviations are found in industrial cooling water consumption. There is also found that there has moderate positive correlation (r values of .410) is found between process and cooling and also in process and domestic with r value of .356. However, strong correlations are found in cooling and domestic as well as in cooling and total water consumption with r values of .731 and .932.

4.4.2.2 Raw Material Consumption

M/s Sahyadri Starch is a manufacturer of maize and liquid glucose. It uses maize and sulpher for manufacturing maize and starch, hydrochloric acid, activated carbon sodium metabisulphate, dicomol, soda, costic soda, resign ion exchange A 368, C-26, resign water softener C 20 are used for producing liquid glucose.

Table No. 4.4.2.2 a

Raw Material Consumption of Sahyadri Starch Industries Pvt. Ltd., Sangli

(in Kg/MT)

Name of Raw Material	2001	2002	2003	2004	2005	2006	207	2008	CGR
Maize	6586	5975	4150.23	4220	4150.23	3320.37	3320.37	925	-18.67
Sulphur	12	11.83	9.5648	9.586	9.5648	8.43	8.43	2.35	-14.83
Starch	992.5	977.5	988	989	988	1157	1157	322.87	-7.49
Hydrochloric Acid	26.54	24.42	25.56	25.16	25.566	29.625	29.625	8.26	35.45
Sodium Hydroxide	-	-	-	-	-	-	-	-	-
Activated Charcoal	3.18	2.86	3.051	3.35	3.057	3.358	3.358	0.94	-8.57
Sodium Meta-bisulphate	0.45	0.48	0.0516	0.052	0.0516	3.779	3.779	1.05	23.32
Dicomaol	2.45	2.14	1.693	1.709	1.693	1607	1.667	0.46	-14.46
Soda	3.33	3.53	3.488	3.5	3.488	4.381	4.381	1.22	-6.07
Resin Ion Exchange 368	0.30	0.01	0.04116	0.04035	0.04116	0.1747	0.1747	0.049	-1.13
Resin Ion Exchange C26	0.10	0.015	0.0325	0.031	0.0325	0.1572	0.1572	0.044	13.68
Fuel and Energy Consumption									
1. Bagasse	1670	1617	1207.11	1222	1207	1912	1972.62	530.1	-7.41
2. LDO	28	27.56	29.368	30.06	29.368	30.560	31.700	32.100	2.10
3. Diesel	8	7.83	6.279	7.25	6.279	6.1143	6.1143	1.705	-13.60
4. Firewood	220.4	250.5	260.352	208.965	260.352	311.109	311.109	80.76	-5.42
Costic Soda	7.668	7.118	6.118	6.17	6.118	8.819	8.0	2.49	-7.116
Resin Water Softener C20	0.0090	0.0100	0.0103	0.01	0.0103	0.0385	0.0385	0.01	14.62

Source : Same as of Table No. 4.4.2.1

Per unit of product kgs to produce metric tonne output is the ratio of raw material consumption. The above table shows that 6586 kg of maize was used in 2001 and consumption reduced by 188.65% to 925 kg/MT. Likewise, sulpher, starch, activated carbon, dicomal, soda, sulpher, resign ion exchange A368 were reduced by 14.83%, 7.49, 8.57, 14.46, 607 and 1.13% whereas consumption of hydrochloric acid was increased by 35.45%, sodium metabisulphate 23.32% and resign ion exchange C 26 by 13.68% and resign water softener C 20 by 14.62%.

In short, it is seen that industry has reduced its raw material consumption of 7 items and seen to be increased in case of 4 types of raw materials.

b) Fuel and Energy Consumption

The pattern of energy and fuel consumption per unit of product output is sown in following table.

Table No. 4.4.2.2 b

Fuel and Energy Consumption Sahyadri Starch Industries Pvt. Ltd., Sangli

Year	Name of the Raw Material			
	Bagasse	LDO	Diesel	Firewood
2001	1670	28	8	220.4
2002	1617	27.56	7.83	250.5
2003	1207	29.36	6.2	260.35
2004	1222	30.06	7.25	208.96
2005	1707	29.36	6.22	260.35
2006	1972	30.56	6.11	311.10
2007	1912	31.70	6.43	311.10
2008	550	32.10	17	86.76
CGR	-7.41	2.10	-13.60	-5.42

Source : Same as of Table No. 4.4.2.1

The above table shows that the industry has LDO, bagasse, diesel and firewood are the main source of energy. 1670 kg of bagasse was used in 2001 to produce metric tonne output and decreased

in 2008 upto 550 kg. This makes clear that industry has reduced the consumption of bagasse by 7.41%. Likewise, diesel consumption also reduced by 13.60%, firewood by 5.42% whereas consumption of LDO increased by 2.10%. In short from the above table it is clear that industry has reduced fuel and energy consumption except LDO over the last 8 years period.

4.4.2.3 Pollutants Discharge to Environment

As earlier stated, pollutants discharged to environment is one important aspect of environmental auditing practices. Industries compliance against MPCB norms or standards are reflected in this part. MPCB in its consent order has given following parameters and its maximum values and industry should compliance against them. Those are –

pH	5.5 to 9.0
Suspended solids	Not to exceed 200 mg/l
BOD	Not to exceed 100 mg/l
COD	Not to exceed 250 mg/l
Oil & Grease	Not to exceed 10 mg/l
Total Dissolved Solids	Not to exceed 2100 mg/l
Sulphate	Not to exceed 1000 mg/l
Chloride	Not to exceed 600 mg/l

Against these Indian standards of effluent industries performance or compliance are shown in the Table No. 4.4.2.3 a.

Table No. 4.4.2.3 a

Pollution Discharged to Environment by Sahyadri Starch Industries Pvt. Ltd., Sangli

(in mg/L)

Treatment

Pollutant	2001-02	2003-04	2005-06	2007-08	CGR
pH	7.22	7.25	7.15	7.15	-0.43
COD	72	78	80	88	6.47
BOD	13.2	13	12.6	12.6	-1.69
Oil & Grease	-	-	-	-	-
TDS	691.2	690	690	700	0.38
Suspended Solids	16.8	70	22	21	4.76
Chloride	132	135	136	132	0.07

Source : Same as of Table No. 4.4.21.

The above table helps to analyse industries compliance against standards prescribed.

.1. pH

pH is the very first parameter that shows the quality of water in industrial campus. In 2001-02 pH value was recorded at 7.15, in 2007-08, which shows that industry has achieved permitted value for pH.

2. COD

COD is one more important parameter. In 2001-02 treated value for COD was recorded at 72, which increased to 88 in 2008 to and standard limit is 100 mg/L. So far it was under the limit even though these were increased by CGR of 6.47% in last 8 years. They have excess of 20% to reach at standardised limit.

3. BOD

The value of BOD was recorded at 13.2 mg/l in 2001-02 and it decreased to 12.6 mg/L. It makes clear that BOD value was reduced by 1.69%.

4. Oil and Grease

Industry did not discharge any quantity of this pollutant.

5. TDS

In 2001-02, TDS was recorded at 691.2 mg/l and it increasingly recorded at 700 mg/l in 2007-08. These values were increased by 0.38% over the last 8 years and have margin to reach at standardized limits that is 2100 mg/L.

6. Suspended Solids

The value for suspended solids was recorded at 16.8 mg/l in 2001-02, and it increased by 4.76% and recorded at 21 mg/l in 2007-08. The values were also within the limits of Indian standards, which is 200 mg/L.

7. Chlorides

The values of chlorides were recorded at 132 in 2001-02 and it remained same in 2007-08. However, during the study period, it increased by 0.07%. These values were in the limits of Indian standards.

From the above table it is clear that this industry was in full compliance against the Indian standards.

b) Waste Water Quantity

To reduce waste is much important in the task of pollution control and natural resources conservation. On this particular background, industrial waste water quantities are described in the Table No. 4.4.2.3 b.

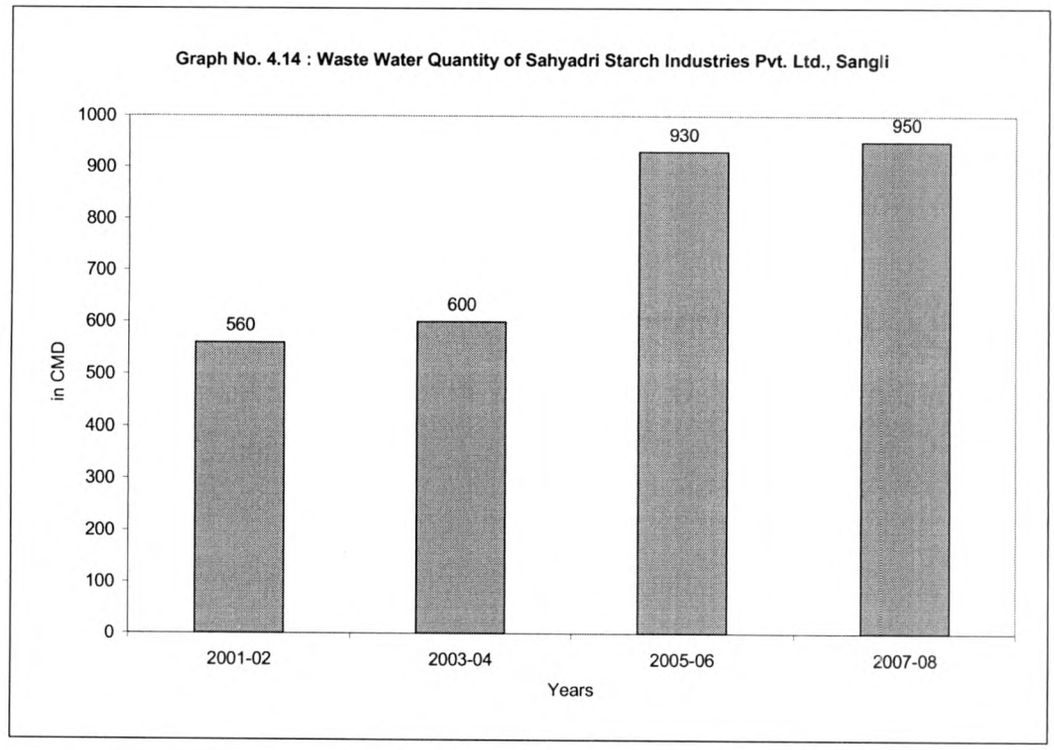
Table No. 4.4.2.3 b

Waste Water Quantity of Sahyadri Starch Industries Pvt. Ltd., Sangli

(in CMD)

Year	Waste Water Quantity
2001-02	560
2003-04	600
2005-06	930
2007-08	950
CGR	22.43

Source : Same as of Table No. 4.4.2.1



The above table shows that industry has increased their generated waste quantity. In 2001 it has generated 500 cum/day and it is increasingly recorded at 950 cum/day in 2008. The growth rate observed during this period was 22.43%. It is necessary that they have to reduce the waste water quantity.

c) Ambient Air Quality Analysis

The factory has conducted ambient air quality and stack quality analysis and it is shown in the following table.

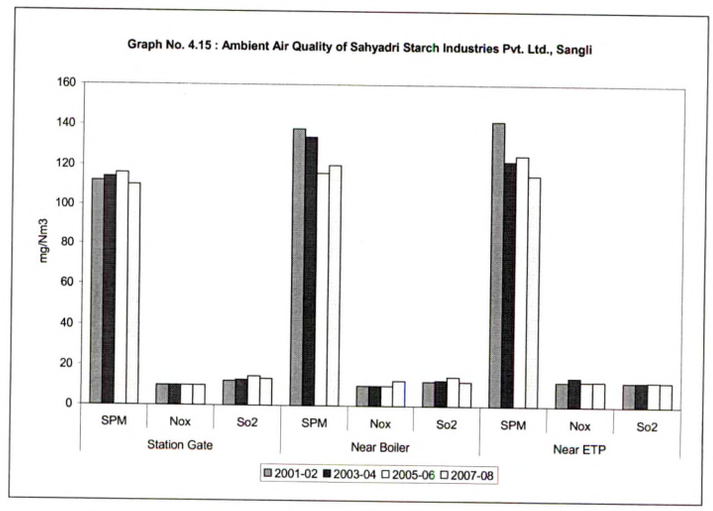
Table No. 4.4.2.3 c

Ambient Air Quality of Sahyadri Starch Industries Pvt. Ltd., Sangli

(in mg/Nm^3)

Year	Station Gate		
	SPM	No_x	So_2
2001-02	112	10	12.2
2003-04	114	10	12.84
2005-06	116	10	14.6
2007-08	110	10	13.4
CGR	-0.36	0	4.18
Year	Near Boiler		
	SPM	No_x	So_2
2001-02	138	10	12.2
2003-04	134	10	12.84
2005-06	116	10	14.6
2007-08	120	12.48	12.1
CGR	-5.47	6.87	1.04
Year	Near ETP		
	SPM	No_x	So_2
2001-02	142	12.2	12.1
2003-04	122	14.4	12.23
2005-06	125	12.4	12.45
2007-08	115	12.48	12.25
CGR	-5.90	-0.81	0.54

Source : Same as of Table No. 4.4.2.1



Factory has carried out air quality monitoring at three different stations.

1. Station at Main Gate

At the station of main gate in 2001-02 SPM was recorded at 112 mg/Nm^3 and it decreased by 0.36% and recorded at 110 mg/Nm^3 in 2007-08. Whereas values of No_x remained the same during the last 8 years. The values of So_2 were recorded at 12.2 mg/Nm^3 in 2001-02, which were increasingly recorded at 13.4 mg/Nm^3 with 4.18 CGR in 2001-02.

2. Near the Boiler

The values of SPM in 2001-02 were recorded at 138 mg/Nm^3 and reduced to 120 mg/Nm^3. The SPM values were reduced by 5.47% during the years under study. The standard deviation was very highly recorded at 106548 for SPM, whereas the values for No_x were increased by 1.04- and less standard deviations were also found in the value of that parameter.

3. Near ETP

In 2001-02 near ETP SPM was recorded at 142 mg/Nm^3 and increased in 5.90% and recorded at 115 mg/Nm^3 in 2007-08 whereas there was a slight decline in No_x that is 0.81 and So_2 that is 0.54 and also found less standard deviation.

From the above table, researcher has observed that on all 3 stations SPM was reduced and also high standard deviations. It is clear that industry has succeeded in keeping the values of SPM, No_x and So_2 within the limits of MPCB limits.

4.4.2.3 d Stack Monitoring Analysis

Like ambient air quality monitoring industry has also carried out stack monitoring programme in 3 stack phases.

Table No. 4.4.2.7

Stack Monitoring Analysis of Sahyadri Starch Industries Pvt. Ltd., Sangli

Stack – I

Year	Stack Height (in meter)	Stack Diameter (in meter)	Boiler Type	Fuel	Boiler Make	Stack Material	Gas Velocity	F. G. Temperature	SPM mg/Nm^3	No_x ug/Nm^3	So_2 ug/Nm^3
2001-02	30.5	0.66	Smoke Type	Bagasse	Thermax	MS	8.18	210	120	34	45
2003-04	30.5	0.66	Smoke Type	Bagasse	Thermax	MS	8.18	210	122	30	45
2005-06	30.5	0.66	Smoke Type	Bagasse	Thermax	MS	8.15	211	120	31	45
2007-08	30.5	0.66	Smoke Type	Bagasse	Thermax	MS	8.2	210	130	30	36
CGR	-	-	-	-	-	-	0.25	0.04	2.26	-3.36	-6.26

Source : Same as of Table No. 4.4.2.1

Stack - II

Year	Stack Height	Stack Diameter	Boiler Type	Fuel	Boiler Make	Stack Material	Gas Velocity	F. G. Temperature	SPM mg/Nm^3	No_x ug/Nm^3	So_2 ug/Nm^3
2001-02	28	0.6	Smoke Type	Bagasse	Thermax	MS	8.2	192	110	50	46
2003-04	28	0.6	Smoke Type	Bagasse	Thermax	MS	8.2	192	114	45	50
2005-06	28	0.6	Smoke Type	Bagasse	Thermax	MS	8.17	190	115	46	49
2007-08	28	0.6	Smoke Type	Bagasse	Thermax	MS	8.18	188	110	45	47
CGR	-	-	-	-	-	-	0.22	-0.73	1.95	-2.89	0.44

Stack - III

Year	Stack Height	Stack Diameter	Boiler Type	Fuel	Boiler Make	Stack Material	Gas Velocity	F. G. Temperature	SPM mg/Nm^3	No_x ug/Nm^3	So_2 ug/Nm^3
2001-02	30.6	0.6	Smoke Type	Bagasse	Thermax	MS	8.2	190	110	42	46
2003-04	30.6	0.6	Smoke Type	Bagasse	Thermax	MS	8.2	190	114	40	45
2005-06	30.6	0.6	Smoke Type	Bagasse	Thermax	MS	8.2	180	108	35	40
2007-08	30.6	0.6	Smoke Type	Bagasse	Thermax	MS	8.2	185	105	33	38
CGR	-	-	-	-	-	-	-	-1.33	-1.91	-8.21	-6.67

Source : Same as of Table No. 4.4.2.1

Stack I

In phase of stack I, stack height is 30.5 meter which is as per consent condition that is not less than 30 meter with 0.66 diameter. Industry has smoke type boiler and bagasse is used for fuel. Gas velocity was recorded at 8.18 meter per second in 2001-02, which slightly decreased in 2007-08 and stood at 8.2 m/sec. Fuel gas temperature also reduced during last 8 years, whereas the value of SPM was increasingly recorded over the 8 years. The SPM was recorded at 170 in 2001-02 and 130 in 2007-08, which was increased by 2.26 over the last 8 years period whereas the values of No_x and So_2 were reduced by 3.26% and 6.26 ^during 8 years.

Stack II

In this stack monitoring, stack height was less than stack I that was 28 meter. Its velocity increased by 0.22% and fuel gas temperature was reduced by 1.95% and So_2 by 0.44% whereas No_x value was reduced by 2.89%.

Stack III

In this third phase of stack monitoring, stack height was considered as 30.6 meter. Fuel gas temperature, SPM, No_x, So_2 were reduced by 1.33, 191, 8.21 and 6.67% among which No_x was reduced very fastly at the rate of 8.21%.

It is clear from stack monitoring analysis conducted in 3 different phases in industry that industry has reduced the values of SPM, gas velocity, So_2 and No_x and also kept them with small variations, which clearly shows industry has given 100% compliance against MPCB norms.

4.4.2.4 Noise Pollution

In order to control noise pollution and to compliance against MPCB standards for noise/sound, that is sound should be less than 75 dB for day and 70 dB for night mode. Industry has also carried out

sound level measurement programme for 10 different samples for every two months. The following table shows the actual sound level of industry.

Table No. 4.4.2.4

Sound Level in Factory

(in dB)

Sr. No.	Station	2001-02	2003-04	2005-06	2007-08	CGR	
						Min	Max
1	Maize Godown	50-52	55-62	55-60	59-65	5.09	6.57
2	Mill House	60-62	60-68	65-70	70-74	5.57	5.75
3	Boiler House	80-84	80-86	85-90	88-92	3.52	3.23
4	Starch Decantation	80-82	80-83	80-86	84-88	1.47	2.50
5	Centrifugal Section	81-84	81-84	80-90	85-90	1.33	2.78
6	Liquid Glucose	60-63	60-67	62-72	60-70	3.23	3.95
7	Starch Godown	59-60	59-67	59-65	62-69	1.49	3.96
8	Manager Cabin	48-50	48-52	48-55	50-56	1.23	4.04
9	Laboratory	50-52	50-58	50-58	55.60	2.58	4.38
10	Main Gate	46-48	46-50	48-58	54-59	5.37	7.97

Source : Same as of Table No. 4.4.2.1

In the above table, minimum and maximum values are given and compound growth rate is also calculated for them. From the above table it is clear that industry has become successful in controlling noise pollution for keeping sound less than MPCB norms that is 75 dB at 7 stations of factory. Sound levels at 3 stations was higher than the MPCB norms, which was 75 dB. It means that industry cannot control sound levels and noise pollution at all and CGR of other stations sound level shows there was also trend of increase in sound levels. Industry should try to reduce the sound at the station of boiler house, starch decentralization, central fuel station.

4.4.2.5 Solid Waste

Solid waste and its quantity is given in the following table.

Table No. 4.4.2.5

Solid Waste of Sahyadri Starch Industries Pvt. Ltd., Sangli

(quantity in kg/year)

Solid Waste (in kg)	2001	2002	2003	2004	2005	2006	2007	2008	CGR
From Process	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
From PCF & ETP Sludge	6020	6000	6030	6040	6030	6040	6040	6050	0.084
1. Quantity Recycled or Reused	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
2. Sold	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
3. Disposed	6020	6000	6030	6040	6030	6040	6040	6050	0.084

Source : Same as of Table No. 4.4.2.1

From the above table one may clear that, from process industry could not generated any solid waste quantities. However, from pollution control facilities and ETP sludge, it generates waste. In 2001-02 such waste was 6020 kg and such figures slightly increased by 2007-08 to 6050 kg with CGR of 0.08%. The same quantity of solid waste was disposed on their own premises.

4.5 Environmental Audit : An Empirical Analysis of Small Scale Industries in Sangli District

Small scale industries play a key role in the industrialization of Sangli district. A small industry is presently defined as a unit engaged in manufacturing, servicing, repairing, processing and presentation of goods having investment in plant and machinery at an original cost not exceeding Rs. 60 lakhs.

The definition of small scale industries recommended by the Small Scale Industries Board 1966 and as per the Ministry of Industry letter No. SSI(A) 13(5)/166 dated 31st October 1966 is as follows :

"Small scale industries will include all industrial units with a capital investment of not more than Rs. 7.5 lakhs irrespective of the number of persons employed. Capital investment so far this purpose will mean investment in plant and machinery only."[8]

After analysing environmental auditing practices of large and medium scale industrial units, in following sub sections an attempt is made for providing empirical analysis of small scale industries in Sangli district.

4.5.1 Environmental Auditing of C. I. Casting and Foundries

Environmental auditing practices of 6 foundries and C. I. casting industrial units of Sangli district are discussed in following sub section.

4.5.1.1 Environmental Auditing of Json's Foundries Pvt. Ltd.

Environmental auditing practices of Json's Foundries are described in the following sub sections.

4.5.1.1.1 Water Consumption

As far as foundry industries are concerned, they consume water only for domestic and cooling purposes. In this context MPCB has given the following norms related to water consumption.

i)	Domestic	-	0.4 CMD
ii)	Industrial Processing	-	Nil
iii)	Industrial Cooling	-	0.8 CMD

It is against these standard limits actual water consumption is shown in the following table.

Table No. 4.5.1.1.1

Water Consumption of Jason's Foundry Industries Pvt. Ltd., Sangli

(in CMD)

Year	Process	Cooling	Domestic	Gardening	Total
2001	-	1 (43.70)	0.3 (13.04)	1 (43.70)	2.30 (100)
2002	-	1 (43.70)	0.3 (13.04)	1 (43.70)	2.30 (100)
2003	-	1 (43.70)	0.3 (13.04)	1 (43.70)	2.30 (100)
2004	-	1 (43.70)	0.3 (13.04)	1 (43.70)	2.30 (100)
2005	-	1 (43.70)	0.3 (13.04)	1 (43.70)	2.30 (100)
2006	-	1 (43.66)	0.3 (16.66)	1 (41.66)	2.40 (100)
2007	-	1 (43.66)	0.3 (16.66)	1 (41.66)	2.40 (100)
CGR	-	-	0.25	-	0.4

Source : Environmental Statement Reports of M/s Jsons Foundry Pvt. Ltd. for the year 2001 to 2008 submitted to MPCB, Sangli

The above table shows the categorywise water consumption of Jason's Foundries for over the 8 years of study period. As per consent conditions industry need not consume any quantity of water for processing purpose. In 2001, Jsons Foundry has consumed 1 CMD water for cooling purpose and it remained the same upto 2008. This was excess water consumption than the permissible limit of 0.8 CMD. Its percentage share stood for at 43.70% in 2001, which declined in 2008 to 41.66%.

Water used for domestic purposes recorded at -.3 CMD, which was less than 0.4 that is permitted quantity given by the MPCB. However, in last 3 years industry has used equal quantity of water with permissible quantity.

Along with domestic purposes foundry has been using water for gardening also. It has consumed 1 CMD water, which was 43.70 percent of its total water consumption. Moreover, it remained stable upto 2008. In summation, foundry has used 2.3 CMD water and it increased by 0.41% and went upto 2.4 CMD water in 2008.

There was no standard deviation found in water consumed for cooling. However water consumed for processing and domestic purposes, the standard deviation was (51.75) higher.

4.5.1.1.2 Raw Material Consumption

As far as foundries are concerned, M. S. scrap, stainless steel, foundry chemicals, ferrous alloys are the important raw materials consumed, which is shown in following table.

Table No. 4.5.1.1.2

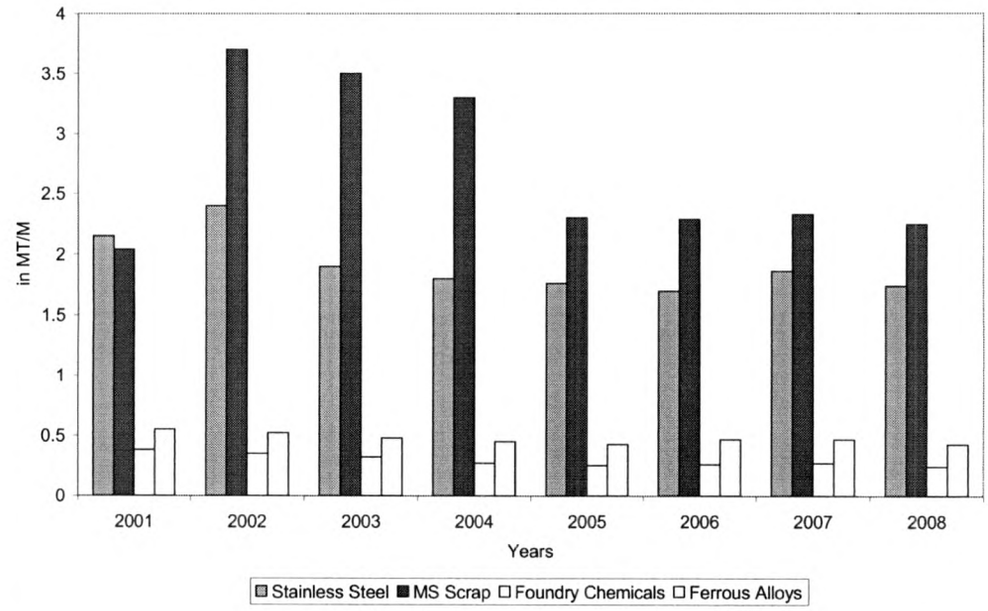
Raw Material Consumption of Jason's Foundry Industries Pvt. Ltd., Sangli

(in MT/M)

Year	Name of Raw Material			
	Stainless Steel	MS Scrap	Foundry Chemicals	Ferrous Alloys
2001	2.15	2.04	0.38	0.55
2002	2.4	3.7	0.35	0.52
2003	1.9	3.5	0.32	0.48
2004	1.8	3.3	0.27	0.45
2005	1.76	2.3	0.25	0.43
2006	1.7	2.29	0.26	0.47
2007	1.86	2.33	0.27	0.47
2008	1.74	2.25	0.24	0.43
CGR	- 0.77	- 5.10	- 6.01	- 2.69

Source : Same as of Table No. 4.5.1.1.1

Graph No. 4.16 : Raw Material Consumption of Jason's Foundry Industries Pvt. Ltd., Sangli



The above table clearly shows that foundry has reduced its raw materials consumption during 8 years period. In the study period, foundry has reduced consumption of stainless steel by 0.77%, MS scrap by 5.10%, foundry chemicals by 6.01% and ferrous alloys by 2.69%. Most importantly they have become successful in reducing the consumption of MS scrap and foundry chemicals compared to others.

4.5.1.1.3 Pollutants Discharged to the Environment

As far as foundry industries are concerned their pollutants discharge to the environment only takes place through domestic waste water and ambient air quality analysis. Domestic waste water generation by Jason's Foundry is shown in the following table.

Table No. 4.5.1.1.3 a

Domestic Waste Water of Jason's Foundry Industries Pvt. Ltd., Sangli

(in CMD)

Year	Domestic Waste Water
2001-02	0.7
2003-04	0.5
2005-06	0.3
2007-08	0.3
CGR	- 26.30

Source : Same as of Table No. 4.5.1.1.1

The above table gives the quantity of waste water generated by Jason's Foundry over the 8 years. As consent given to foundry industries they had put conditions that the daily quantity of 0.3 m^3/day can be discharged. However, above table shows that Jsons Foundry had generated domestic waste of 0.7 m^3/day in 2007-08. This waste water quantity was higher than the MPCB norms. Hence, it should try to reduce the waste water quantity and to achieve permissible quantity of waste water, that is 0.3 m^3/day. Moreover, it is seen that since 2005 it has become successful in reducing waste water quantities and achieved permissible waste water quantity.

b) Ambient Air Quality

Ambient air quality is another aspect of pollution discharge to the environment by foundry industries. The MPCB has given standardized limits for SPM, that is SPM should not exceed 150 mg/Nm^3 and for No_x, So_2 such limits were not prescribed for small industries.

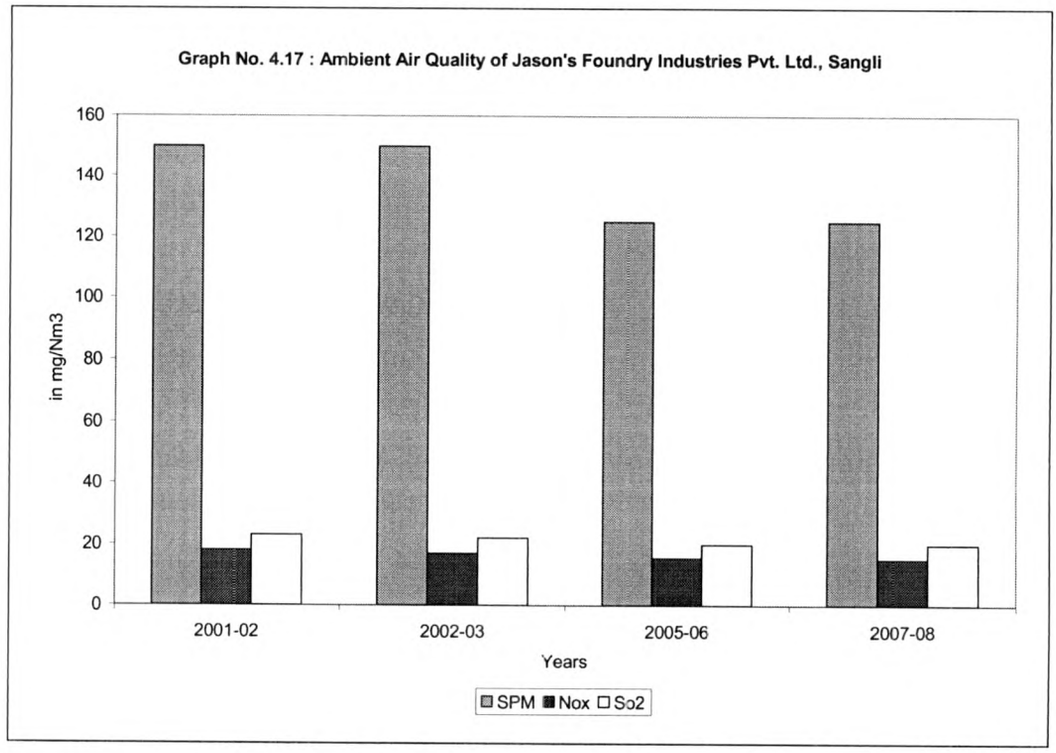
Table No. 4.5.1.1.3 b

Ambient Air Quality of Jason's Foundry Industries Pvt. Ltd., Sangli

(in mg/Nm^3)

Year	SPM	No_x	So_2
2001-02	150	18	23
2002-03	150	17	22
2005-06	125	15.5	20
2007-08	125	15	20
CGR	- 9.18	- 6.19	- 5.01

Source : Same as of Table No. 4.5.1.1



The above table shows that in 2001-02 foundry has been complaining with MPCB standards for SPM concentration, which was exactly recorded at 150 mg/Nm^3 in 2001-02, but upto 2007-08 its values were declined by 9.18% and it was recorded at 125 mg/Nm^3.

In the case of other types of air pollutants their values were also reduced by 6.19% for No_x and So_2 for 5.01%.

In short, industry has become successful in control of air pollution over the 8 years, but a high standard deviation was found in SPM.

4.5.1.1.4 Hazardous Waste

Foundry industries are responsible for process dust generated in processing. MPCB has given 150 kg of process dust as maximum dust quantity for Jason's Foundry. Against this standardize limit of process dust actual generation of process dust is shown in the following table.

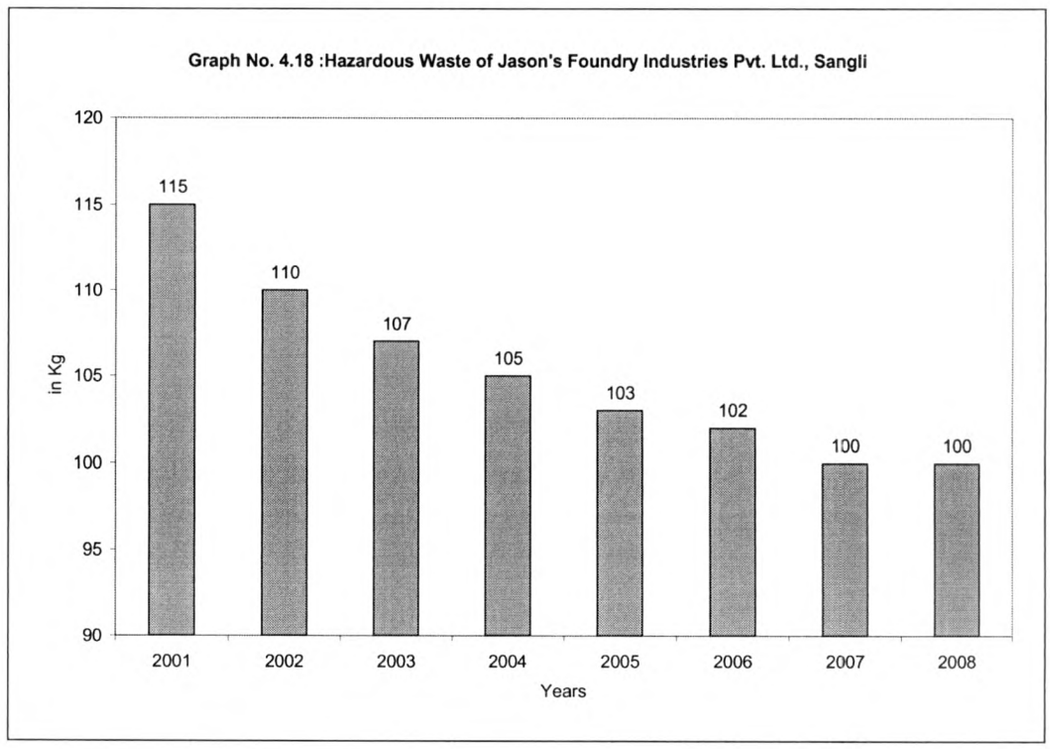
Table No. 4.5.1.1.4

Hazardous Waste of Jason's Foundry Industries Pvt. Ltd., Sangli

(in kg)

Year	Process Dust
2001	115
2002	110
2003	107
2004	105
2005	103
2006	102
2007	100
2008	100
CGR	0.13

Source : Same as of Table No. 4.5.1.1.1



From the above table it is clear that complaining efforts of Jason's Foundry will help them to reduce the process dust quantity upto 100 kg in 2008, which was 115 kg in 2001. This industry has reduced process dust by 0.13% during the study period.

Table No. 4.5.1.1.5
Solid Waste

(quantity in MT)

Item	2001	2002	2003	2004	2005	2006	2007	2008	CGR
From Process	-	-	-	-	-	-	-	-	-
From PCF & ETP Sludge	85	81	78	76	75	73	72	66	-22.35
Quantity Recycled	85	81	78	76	75	73	72	66	-22.35
Sold	-	-	-	-	-	-	-	-	-
Disposed	-	-	-	-	-	-	-	-	-

Source : Same as of Table No. 4.5.1.1.1

As far foundries are concerned they are only generating solid waste from pollution control facilities and ETP sludge, and it was recorded at 85 MT in 2001, which was reduced by 22.35% and all waste quantity is being recycled in process.

4.5.1.2 Environmental Auditing of Jagdeesh Iron & Steel Pvt. Ltd.

Environmental auditing practices of Jagdeesh Iron & Steel Industry has been discussed as below.

4.5.1.2.1 Water Consumption

Like foundry industry, C. I. casting industries also does not consume any quantity of water for processing purpose. Maharashtra Pollution Control Board has given following standards for cooling and domestic consumption of water in terms of quantity.

Domestic	-	0.5 CMD
Processing	-	Nil
Cooling	-	3.0 CMD

Against these standards the actual water consumption of Jagdeesh Iron & Steel Ltd. is given in the following table.

Table No. 4.5.1.2.1

Water Consumption of Jagdeesh Iron & Steel Pvt. Ltd.

(in CMD)

Year	Process	Cooling	Domestic	Total
2001	-	2 (40)	3 (60)	5 (100)
2002	-	1.9 (39.58)	2.9 (60.41)	4.8 (100)
2003	-	1.8 (40)	2.7 (60)	4.5 (100)
2004	-	1.7 (39.53)	2.6 (60)	4.3 (100)
2005	-	1.7 (39.53)	2.6 (60)	4.3 (100)
2006	-	1.5 (37.5)	2.5 (62.50)	4 (100)
2007	-	2.5 (50)	2.5 (50)	5 (100)
2008	-	2.5 (50)	2.5 (50)	5 (100)
CGR	-	3.48	-2.64	-0.17

Source : Environmental Statement Report of Jagdeesh Iron & Steel Pvt. Ltd. for financial years 2001 to 2008.

Note : Figures in the brackets shows the percentage to total.

In the above table 4.5.1.2.1 the cooling water consumption is recorded at 2 CMD in 2001, which comprised 40% of total water consumption, which increased in 2008 to 2.5 CMD with 50% of total water consumption. And standard deviation in cooling water consumption stood at 37.03.

Likewise, the domestic water consumption recorded at 3 CMD in 2001 with 60% of total water consumption, which was reduced by 2.64 in 2008 and recorded at 2.5 CMD with 50% of total water consumption. The total water consumption was recorded at 5 CMD in 2001, which was slightly reduced by 0.17 during the study period.

In short, from the above table it is clear that cooling water consumption was in the limits of MPCB norms even though it increased by 3.41 during the 8 years. Whereas domestic water consumption was high than permissible limits. There was strong positive correlation with .874 r value is found between cooling water consumption and total water consumption, whereas positive and moderate correlation was found with r value of .349 between domestic and total water consumption.

4.5.1.2.2 Raw Material Consumption

Pig iron and MS scrap are the two important raw materials for Jagdeesh Iron & Steel Pvt. Ltd., consumption of such materials is shown in the following table.

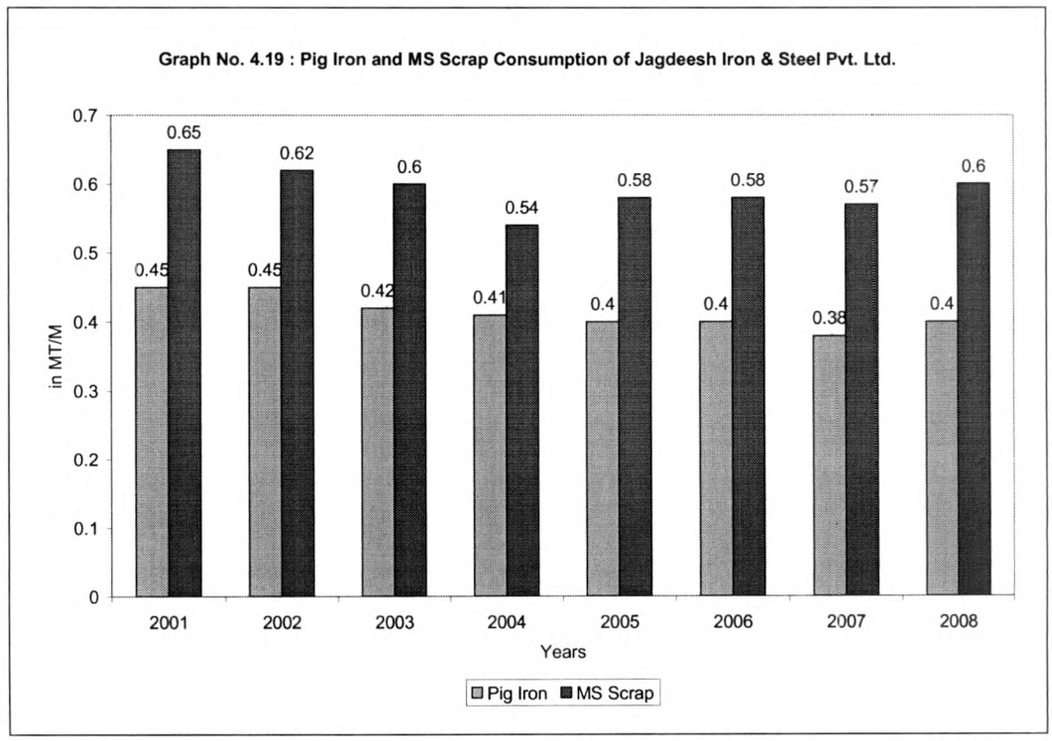
Table No. 4.5.1.2.2

Pig Iron and MS Scrap Consumption of Jagdeesh Iron & Steel Pvt. Ltd.

(in MT/M)

Name of the Raw Material	2001	2002	2003	2004	2005	2006	2007	2008	CGR
Pig Iron	0.45	0.45	0.42	0.41	0.40	0.40	0.38	0.40	-2.16
MS Scrap	0.65	0.62	0.60	0.54	0.58	0.58	0.57	0.60	-1.30

Source : Same as of Table No. 4.5.1.2.1



In the above table, in 2001 Pig iron and MS scrap consumed at 0.45 and 0.65 MT/M, which reduced in 2008 to 0.40 MT/M of pig iron and 0.60 MT/M of MS scrap. In this case pig iron was reduced by 2.16% and MS scrap by 1.30%. Consumption of both raw materials was reduced during the study period and it is sign of resource conservation and reduction in the cost of production.

4.5.1.2.3 Pollutants Discharged to Environment

This part analyses ambient air quality and measurement of industrial waste quality.

1. Ambient Air Quality

For this analysis, the researcher considered the same norms prescribed in the above sub sections especially in 4.5.1.2.1 regarding the SPM norms and waste water quantity. The actual concentration of SPM, No_x and So_2 is shown in the following table.

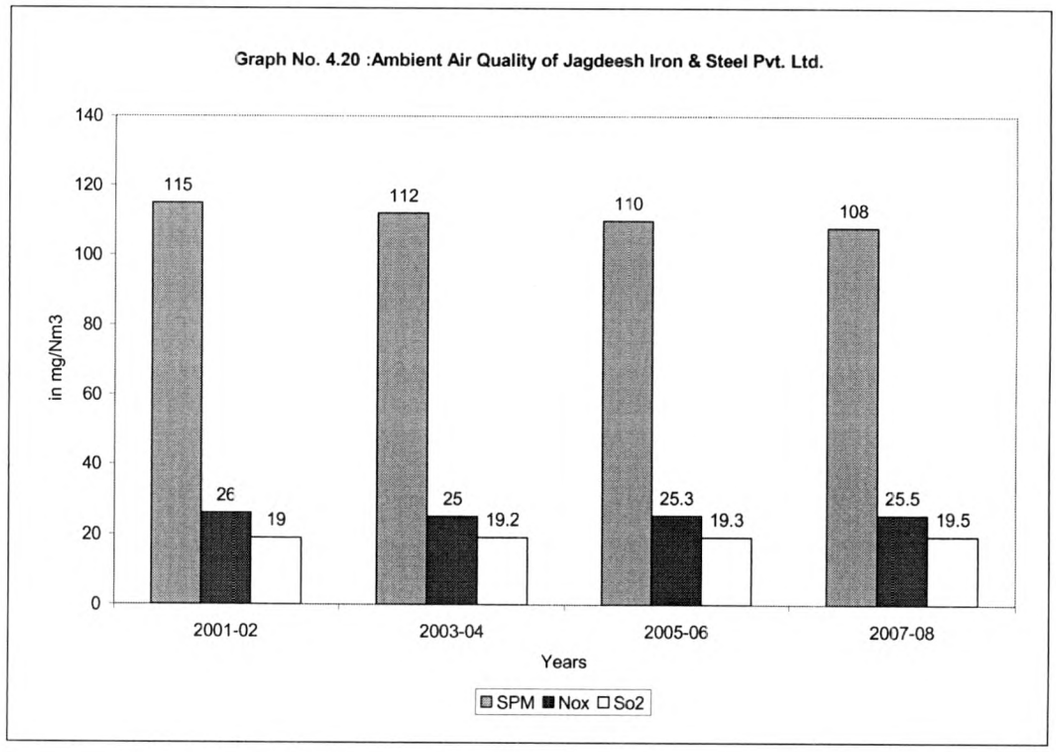
Table No. 4.5.1.2.3 a

Ambient Air Quality of Jagdeesh Iron & Steel Pvt. Ltd.

(mg/Nm^3)

Year	SPM	No_x	So_2
2001-02	115	26	19
2003-04	112	25	19.2
2005-06	110	25.3	19.3
2007-08	108	25.5	19.5
CGR	-2.04	-0.66	0.83

Source : Same as of Table No. 4.5.1.2.1



In order to compliance the standardized limits of SPM, that is 150 mg/Nm^3, the actual concentration of SPM was recorded at 115 mg/Nm^3 in 2001-02, which decreased in 2007-08 upto 108 mg/Nm^3. SPM was reduced by 2.04% whereas No_x concentration also was reduced by 0.46%,. But the So_2 concentration was increased by 0.83% during the study period.

2. Waste Water Quantity

Waste water quantity is another aspect of pollution discharge to environment for foundry as well as iron and steel industries. The MPCB has given the standardized limits of daily waste water quantity, which is 0.3 m^3/day. Against this standard, actual waste water quantity is given in the following table.

Table No. 4.5.1.2.3 b

Waste Water Quantity of Jagdeesh Iron & Steel Pvt. Ltd.

(in CMD)

Year	Waste Water
2001-02	1.2
2003-04	1.2
2005-06	1.2
2007-08	1
CGR	-5.32

Source : Same as of Table No. 4.5.1.2.1

In the above table, domestic waste water generated by industry was recorded at 1.2 CMD, which was reduced by 5.32% and recorded at 1 CMD in 2007-08. Even it was reduced the quantity of waste water, their actual waste water quantity was higher than permissible quantity. Therefore, it should try to reduce the waste water quantity.

4.5.1.2.3 Hazardous Waste

Jagdeesh Iron & Steel Pvt. Ltd. generates hazardous waste from process dust only. Against this permissible limit of 100 kg dust per month, actual generation of process dust is shown in the following table.

Table No. 4.5.1.2.4

Hazardous Waste

(in mg/M)

Name of the Hazardous Waste	2001	2002	2003	2004	2005	2006	2007	2008	CGR
Process Dust	15	15.5	14.5	13	12	10	12	10	-5.80

Source : Same as of Table No. 4.5.1.2.1

In 2001, this industry has generated 15 kg of process dust, and it decreased by 5.80% and recorded at 10 kg per month in 2008. It clearly shows that industry has made 100% compliance against the MPCB norms of hazardous waste.

4.5.1.2.5 Solid Waste

Likewise, hazardous waste industry has generated solid waste from pollution control facilities and ETP sludge. During 2001 to 2008 industry has generated solid waste in the following ways.

Table No. 4.5.1.2.5
Solid Waste

(in MT/M)

Solid Waste	2001	2002	2003	2004	2005	2006	2007	2008	CGR
From Process	-	-	-	-	-	-	-	-	-
From PCF & ETP Sludge	145	140	135	125	125	120	120	120	-287
Quantity Recycled	145	140	135	125	125	120	120	120	-287
Sold	-	-	-	-	-	-	-	-	-

Source : Same as of Table No. 4.5.1.2.1

In the above table, in 2001, industry has generated 145 MT/M of solid waste and decreased by 2.87% over the 8 years and recorded at 120 MT/M.

4.5.1.3 Environmental Auditing of Veeresha Casting Pvt. Ltd.

An empirical analysis of environmental auditing practices adopted by Veeresha Casting Pvt. Ltd. is discussed in the following sub sections.

4.5.1.3.1 Water Consumption

The categorywise water consumption of Veeresha Casting Pvt. Ltd. is shown in Table No. 4.5.1.3.1, whereas MPCB norms for water consumption remained same as per Table No. 4.5.1.2.1

Table No. 4.4.1.3.1

Water Consumption

(in CMD)

Year	Process	Cooling	Domestic	Total
2001	-	1 (50)	1 (50)	2 (100)
2002	-	1 (50)	1 (50)	2 (100)
2003	-	0.7 (50)	0.7 (50)	1.4 (100)
2004	-	0.6 (50)	0.6 (50)	1.2 (100)
2005	-	0.6 (50)	0.6 (50)	1.2 (100)
2006	-	0.5 (50)	0.5 (50)	1 (100)
2007	-	0.5 (50)	0.5 (50)	1 (100)
2008	-	0.5 (50)	0.5 (50)	1 (100)
CGR	-	-10.50	-10.50	-10.70

Source : Environmental Statement Report of Veeresha Casting Pvt. Ltd. for financial years 2001 to 2008.

Note : Figures in the brackets shows percentages to total.

In the above table, water consumed for the cooling and domestic purposes is shown for the period of 2001 to 2008. In 2001 cooling water consumption was recorded at 1 CMD and for domestic purpose it also consumed 1 CMD with the percentage share of 50-50%. This percentage share remained the same upto 2008, but the water consumed in cooling and domestic purposes were reduced by 10.50% and recorded at only 0.5 CMD, which appropriately was equal to the limits of MPCB. The total water consumption was 2 CMD, which reduced by 10.70% and recorded at 1 CMD today. There was also perfect correlation between water used in cooling and domestic purposes and total water consumption with (r values of 1000).

4.5.1.3.2 Raw Material Consumption

Pig iron, MS scrap, GI boring are important raw material for Veeresha Casting Pvt. Ltd. Consumption of such materials is shown in the following table.

Table No. 4.5.1.3.2

Raw Material Consumption

(in MT/M)

Name of the Raw Material	2001	2002	2003	2004	2005	2006	2007	2008	CGR
Pig Iron	0.33	0.33	0.31	0.31	0.29	0.25	0.33	0.3	-2.10
MS Scrap	0.5	0.48	0.46	0.46	0.49	0.44	0.44	0.48	0.38
G. I. Boring	0.35	0.31	0.33	0.29	0.28	0.31	0.31	0.21	-5.20

Source : Same as of Table No. 4.5.1.3.1

In the above table pig iron consumption was recorded at 0.35 and 0.5 MT/M of MS scrap and 10.35 MT/M of G. I. boring which reduced in 2008 utpo 0.3 MT/M of pig iron and G. I. boring consumption was reduced by 5.20% whereas consumption of M. S. scrap has increased over the 8 years by 0.38%.

4.5.1.3.3 Pollution Discharge to Environment

Iron and steel industries pollution discharge to environment is taking place in following two forms.

A) Ambient Air Quality

Ambient air quality analysis is one aspect of pollution discharge to environment in which industry will try to reduce the concentration of air pollutants like SPM, No_x and So_2. The following table shows the concentration of SPM, No_x and So_2 in the maximum limit of MPCB.

Table No. 4.5.1.3.3 a

Ambient Air Quality

(mg/Nm^3)

Year	SPM	No_x	So_2
2001-02	128	10.7	21
2003-04	126.2	12.6	20.5
2005-06	125.5	13	19.7
2007-08	125	13.4	18.5
CGR	-0.76	7.40	-4.32

Source : Same as of Table No. 4.5.1.3.1

The above table of ambient air quality shows that SPM was recorded at 128 mg/Nm^3 in 2001 and slightly decreased upto 125 mg/Nm^3 in 2008, which shows that industry has reduced the concentration of SPM. It is the sign of controlling of air pollution by Veeresha Casting Pvt. Ltd. over the period of 8 years and the standard deviation was found at 131 in SPM concentration.

Likewise, concentration of gaseous pollution mainly So_2 has also reduced by 4.32% but the No_x increased by 7.40%. Hence, it can be suggested that industry should try to reduce No_x concentration. There was less standard deviation was found in gaseous pollutants like No_x and So_2.

b) Waste Water Quality

The waste water quantity of Veeresha Casting Pvt. Ltd. is shown in following table.

Table No. 4.5.1.3.3. b

Waste Water Quantity

(in CMD)

Year	SPM
2001-02	0.3
2003-04	0.29
2005-06	0.27
2007-08	0.28
CGR	-2.47

Source : Same as of Table No. 4.5.1.3.1

Domestic waste water quantity over the 8 years is shown in the above table. In 2001-02 domestic waste water quantity was recorded at 0.3, which was equivalent to MPCB norms and the quantity reduced in 2008 by 0.18 CMD. It reveals that industry has ensured 100% compliance against MPCB norms.

4.5.1.3.4 Hazardous Waste

M/s Veeresha Casting Pvt. Ltd. generates hazardous waste by the source of process dust. The MPCB has given 100 kg per month a standardized limit for generation of process dust. Against this standardized limit actual generation of process dust is shown in the following table.

Table No. 4.5.1.3.4
Hazardous Waste

(in kg)

Year	Process Dust
2001	170
2002	145
2003	155
2004	125
2005	115
2006	100
2007	100
2008	100
CGR	-4.80

Source : Same as of Table No. 4.5.1.3.1

The above table shows that in 2001 industry has generated 170 kg of process dust per month, which was excess quantity than 100 kg that was permitted quantity of process dust. However, this quantity was reduced by 4.80% during the next 8 years and recorded at 100 kg which was equal to permissible quantity. It also shows that industry has ensured 100% compliance against the MPCB norms.

4.5.1.3.5 Solid Waste

Industry also generates solid waste from the source of pollution control facilities and ETP sludge. Waste generated by such source is shown in the following table.

Table No. 4.5.1.3.5

Solid Waste

(in MT/M)

Solid Waste	2001	2002	2003	2004	2005	2006	2007	2008	CGR
From Process	-	-	-	-	-	-	-	-	-
From PCF & ETP Sludge	20	19	16	15	14	12	12	13	7.16
Quantity Recycled	20	19	16	15	14	12	12	13	7.16
Sold	-	-	-	-	-	-	-	-	-

Source : Same as of Table No. 4.5.1.3.4

In the above table, M/s Veeresha Casting Pvt. Ltd. has been responsible for solid waste generated by PCF and ETP sludge, which was accounted for 20 MT in 2001 and reduced by 7.16% in 2008 and accounted for 13 MT. The above table also shows that some quantity was reused for and recycled in production activity.

4.4.1.4 Environmental Auditing of M/s Barvepeco Cast Alloys Pvt. Ltd.

Environmental auditing practices of M/s Barvepeco Cast Alloys Pvt. Ltd. has been taken place in following manner.

4.5.1.4.1 Water Consumption

The following table shows the water consumption of M/s Barvepeco Cast Alloys Pvt. Ltd. did not consume any quantity of water for both process and cooling purposes. It consumed water only for domestic purposes. Yearwise consumption is shown in the table.

Table No. 4.5.1.4.1

Water Consumption of M/s Barvepeco Cast Alloys Pvt. Ltd.

(in CMD)

Year	Process	Cooling	Domestic	Total
2001	-	-	2	2
2002	-	-	2	2
2003	-	-	2	2
2004	-	-	1.8	1.8
2005	-	-	1.7	1.7
2006	-	-	1.5	1.5
2007	-	-	1.5	1.5
2008	-	-	1.5	1.5
CGR	-	-	-5.07	-5.07

Source : Environmental Statement Report of M/s Barvepeco Cast Alloys Ltd., for the financial years 2001 to 2008.

In the above table industry had used water only for domestic purposes. In 2001, it was recorded at 2 CMD, which reduced in study period and recorded at 1.5 CMD. The decline was recorded by 5.08%. The above figures shows that industry has ensured 100% compliance against the MPCB norms relating to domestic water use.

4.5.1.4.2 Raw Material Consumption

Pig iron and MS scrap are the important raw materials for M/s Barvepeco Cast Alloys Pvt. Ltd. The figures of raw materials consumption are shown in the Table No. 4.5.1.3.2.

Table No. 4.5.1.4.2

Raw Material Consumption of M/s Barvepeco Cast Alloys Pvt. Ltd.

(in MT/M)

Name of the Raw Material	2001	2002	2003	2004	2005	2006	2007	2008	CGR
Pig Iron	1	0.95	0.92	0.90	0.82	0.80	0.88	0.85	-18.03
MS Scrap	0.50	0.48	0.48	0.45	0.42	0.40	0.44	0.42	-7.66

Source : Same as of Table No. 4.5.1.4.1

In the above table pig iron is most important raw material, which was reduced by 18.03% during the study period. The consumption of pig iron was recorded at 1 MT/M in 2001, which decreasingly recorded at 0.85 MT/M, whereas consumption of MS scrap was slightly (7.66%) reduced and recorded at 0.5 MT/M in 2001 and it reduced at 0.43 MT/M in 2008. In short, industry has reduced its both types of raw materials consumption.

4.4.1.4.3 Pollution Discharge to Environment

Pollution discharge to environment is concerned to ambient air quality and waste water.

a) Ambient Air Quality

The concentration of air pollutants like SPM and gaseous emissions such as So_2 and No_x are shown in following table.

Table No. 4.5.1.4.3 a

Ambient Air Quality of M/s Barvepeco Cast Alloys Pvt. Ltd.

(mg/Nm^3)

Year	SPM	No_x	So_2
2001-02	148	16	27
2003-04	144	15	26
2005-06	145	15	25
2007-08	142	14	25
CGR	-1.16	3.92	-2.66

Source : Same as of Table No. 4.5.1.4.1

In the above table SPM concentration was reduced to 148 mg/Nm^3 in 2001, which decreased by 1.16% in 2008, and recorded at 142 mg /Nm3, which was in the limits of MPCB, that is 150 mg /Nm3 and also found high deviation in the concentration of SPM compared to So_2 and No_x.

The concentration of No_x and So_2 also have reduced by 3.92 and 2.66% during the study period.

b) Waste Water Quantity

Domestic waste water quantity of M/s Barvepeco Cast Alloys Pvt. Ltd. is shown in the following table.

Table No. 4.5.1.4.3 b

Waste Water Quantity of M/s Barvepeco Cast Alloys Pvt. Ltd.

(in CMD)

Year	SPM
2001-02	1
2003-04	1
2005-06	0.9
2007-08	0.8
CGR	-7.45

Source : Same as of Table No. 4.5.1.4.1

In the above table domestic waste water was recorded at 1 CMD in 2001, which slightly declined by 0.8 CMD in 2008. This shows that industry has reduced its domestic water consumption.

4.5.1.4.4 Solid Waste

M/s Barvepeco Cast Alloys Pvt. Ltd. has been responsible for solid waste generation from pollution control facilities and ETP sludge.

Table No. 4.5.1.4.4

Solid Waste of M/s Barvepeco Cast Alloys Pvt. Ltd.

(in MT/M)

Solid Waste	2001	2002	2003	2004	2005	2006	2007	2008	CGR
From Process	-	-	-	-	-	-	-	-	-
From PCF & ETP Sludge	30	30	28	28	26	25	25	23	-3.72
Quantity Recycled	30	30	28	28	26	25	25	23	-3.72
Sold	-	-	-	-	-	-	-	-	-

Source : Same as of Table No. 4.5.1.4.1

In the above table, solid waste generated in M/s Barvepeco Cast Alloys Pvt. Ltd. from PCF and ETP sludge was recorded at 30 MT/M

in 2001. This was reduced by 3.72% during the study period and recorded at 23 MT/M in 2008. The same waste quantity was recycled into production process was observed.

4.5.1.5 Environmental Auditing of Vikrant Metal Industries Pvt. Ltd.

An empirical analysis of environmental auditing practices are summarized below.

4.5.1.5.1 Water Consumption

Table No. 4.5.1.5.1

Water Consumption of Vikrant Metal Industries Pvt. Ltd.

(in CMD)

Year	Process	Cooling	Domestic	Total
2001	-	-	2.5	2.5
2002	-	-	2.4	2.4
2003	-	-	2.3	2.3
2004	-	-	2.2	2.2
2005	-	-	2.1	2.1
2006	-	-	2	2
2007	-	-	2	2
2008	-	-	2	2
CGR	-	-	-3.43	-3.43

Source : Environmental Statement Report of M/s Vikrant Metal Industries Pvt. Ltd., for financial years 2001 to 2008.

In the above table only domestic water consumption was recorded in 2001 at 2.5 CMD, which declined by 3.43% and recorded at 2 CMD in 2008. However, this consumption was also higher than permissible limits of 0.5 CMD.

4.5.1.5.2 Raw Material Consumption

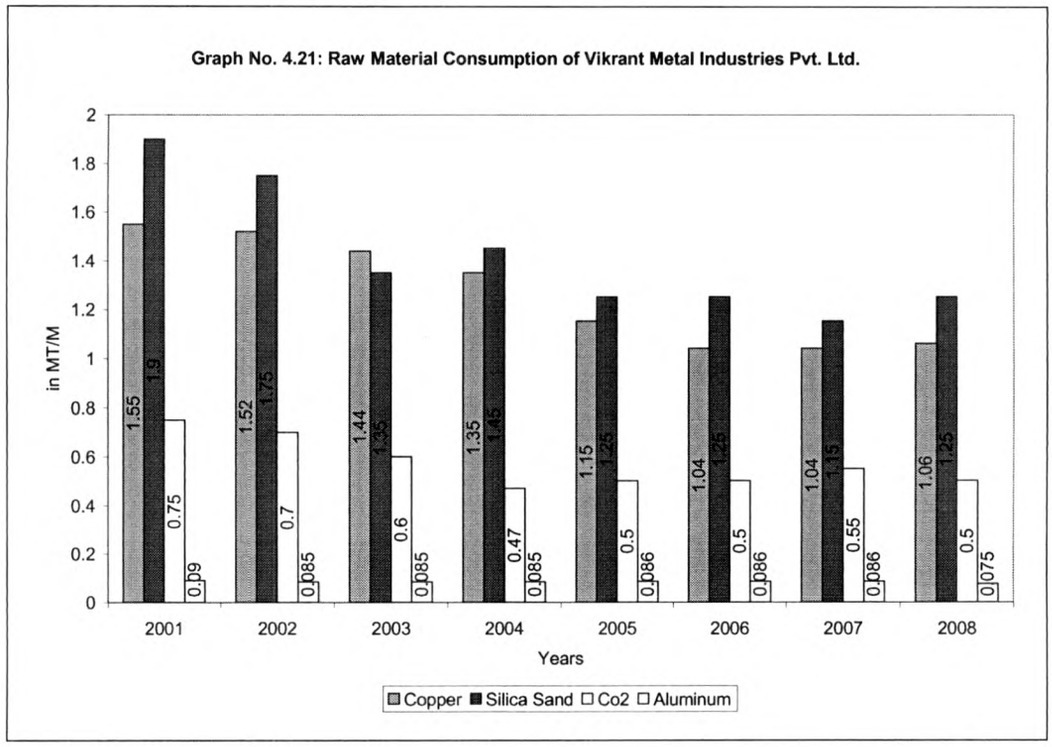
Copper, silica sand, Co_2 and aluminum are the important raw materials for production. The yearwise consumption of these raw materials is shown in Table No. 4.5.1.5.2.

Table No. 4.5.1.5.2

Raw Material Consumption of Vikrant Metal Industries Pvt. Ltd.

Name of the Raw Material	2001	2002	2003	2004	2005	2006	2007	2008	CGR
Copper	1.55	1.52	1.44	1.35	1.15	1.04	1.04	1.06	-6.55
Silica Sand	1.9	1.75	1.35	1.45	1.25	1.25	1.15	1.25	-6.97
Co_2	0.75	0.70	0.6	0.47	0.50	0.5	0.55	0.5	-4.92
Aluminum	0.09	0.085	0.085	0.085	0.086	0.086	0.086	0.075	-1.39

Source : Same as of Table No. 4.5.1.5.1



In the above table, consumption of copper was recorded at 1.55 MT/M in 2001 and decreasingly recorded at 1.06 in 2008. The compound growth rate for reduction was measured at 6.55%. Likewise the consumption of silica sand also reduced by 6.97, which was recorded at 1.9 in 2001 and decreased upto 1.25 MT/M in 2008. The consumption of Co_2 also reduced by 4.92% and recorded at 0.5 MT/M in 2001. Likewise consumption of aluminum was also reduced by 1.39% and recorded at 0.075 MT/M in 2008, which was previously recorded at 0.09 MT/M in 2001.

In short, M/s Vikrant Metal Industries Pvt. Ltd. has reduced its raw materials consumption during the study period.

4.5.1.5.3 Pollution Discharge to Environment

An empirical analysis of pollution discharge to environment of M/s Vikrant Metal Industries Pvt. Ltd. is discussed as follows.

a) Ambient Air Quality

Ambient air quality analysis with given data relating to concentration of air pollutants namely SPM and gaseous emission in the following table against the standardize limits. .

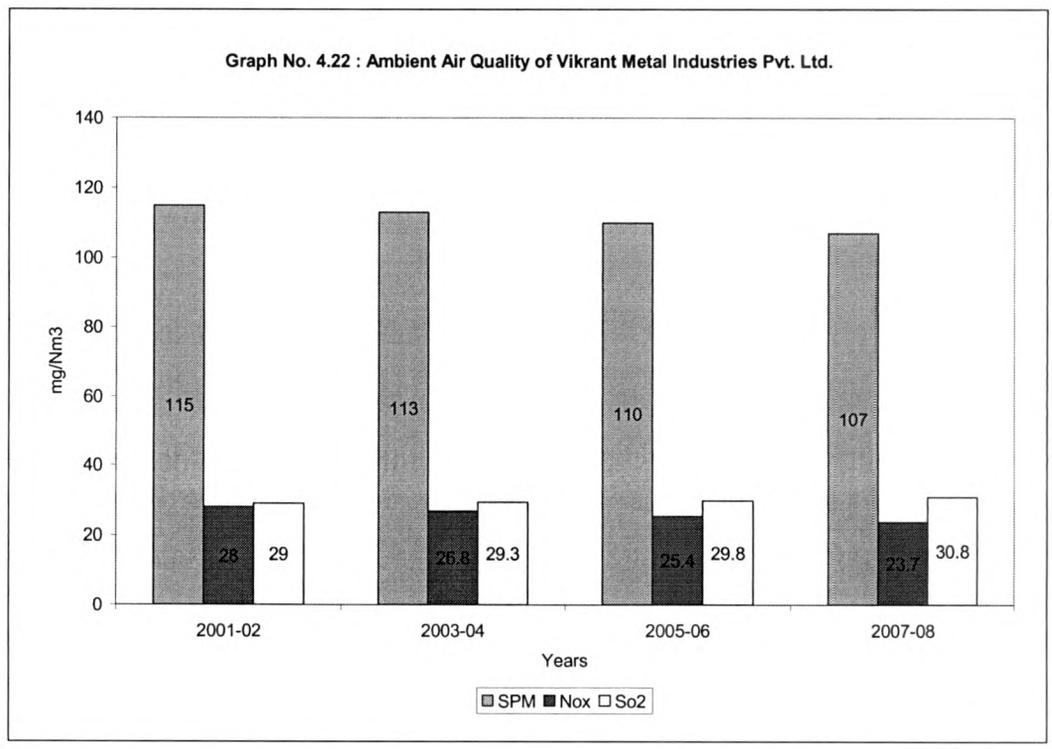
Table No. 4.5.1.5.3 a

Ambient Air Quality of Vikrant Metal Industries Pvt. Ltd.

(mg/Nm^3)

Year	SPM	No_x	So_2
2001-02	115	28	29
2003-04	113	26.8	29.3
2005-06	110	25.4	29.8
2007-08	107	23.7	30.8
CGR	-2.40	-5.38	1.99

Source : Same as of Table No. 4.5.1.5.1



The above table of ambient air quality gives the concentration figures of SPM, No_x and So_2. In 2001 concentration of SPM was recorded at 115 mg/Nm^3, which slightly decreased to 107 mg/Nm^3. These figures were reduced by 2.40% during the study period. Likewise the concentration of No_x also reduced by 5.38% whereas So_2 values were increased by 1.99%.

The standard deviation was 3.50 of SPM concentration and less standard deviations were found in the values of No_x and So_2. It is also clear from the above analysis that industry has ensured compliance against the MPCB norms.

b) Waste Water Quantity

Domestic waste water quantity of M/s Vikrant Metal Industries Pvt. Ltd. is shown in the Table No. 4.5.1.5.3 b.

Table No. 4.5.1.5.3 b

Waste Water Quantity of Vikrant Metal Industries Pvt. Ltd.

(in CMD)

Year	Waste Water Quantity
2001-02	1.5
2003-04	1.4
2005-06	1
2007-08	1
CGR	-14.38

Source : Same as of Table No. 4.5.1.5.1

In the above table domestic waste water quantity for 2001 to 2008 is shown. In 2001, industry has waste water quantity of 1.5 CMD, which decreasingly recorded at 1 CMD in 2008. The quantity was reduced by 14.38% during the study period..

4.5.1.5.4 Hazardous Waste

M/s Vikrant Metal Industries Pvt. Ltd. has generated hazardous waste from the source of process dust. The MPCB has given 100 kg per month as a maximum limit of generation of process dust.

The following table shows generation of process dust for the period of 8 years.

Table No. 4.5.1.5.4

Hazardous Waste

(in kg)

Year	Process Dust
2001	65
2002	61
2003	55
2004	50
2005	45
2006	40
2007	40
2008	41
CGR	-3.40

Source : Same as of Table No. 4.5.1.3.1

The table No. 4.5.1.5.4 shows the process dust generated by M/s Vikrant Metal Industries Pvt. Ltd. recorded at 65 in 2001 and decreasingly recorded at 41 kg/month in 2008. These figures of process dust generation were under the limits of MPCB and the industry has ensured compliance against the norms to control the hazardous waste.

4.5.1.5.5 Solid Waste

M/s Vikrant Metal Industries Pvt. Ltd. has been responsible for solid waste generation from pollution control facilities and ETP sludge.

Table No. 4.5.1.5.5

Solid Waste of M/s Vikrant Metal Industries Pvt. Ltd.

(in MT/M)

Solid Waste	2001	2002	2003	2004	2005	2006	2007	2008	CGR
From Process	-	-	-	-	-	-	-	-	-
From PCF & ETP Sludge	54	52.5	53	51	50	48	48	36	-4.19
Quantity Recycled	54	52.5	53	51	50	48	48	36	-4.19
Sold	-	-	-	-	-	-	-	-	-

Source : Same as of Table No. 4.5.1.5.1

In the above table quantity of solid waste generation was recorded at 54 MT/M in 2001, and it reduced by 36 MT/M in 2008. This reduction was by 4.19% and the same quantity recycled in the process.

4.5.1.6 Environmental Auditing of Shree Kedar Metal Foundries

Empirical analysis of environmental auditing practices accepted by Shree Kedar Metal Foundries are discussed in the following sub section.

4.5.1.6.1 Water Consumption

Water consumption of Shree Kedar Metal Foundries Pvt. Ltd. is shown in the following table.

Table No. 4.5.1.6.1

Water Consumption of Shree Kedar Metal Foundries Pvt. Ltd.

(in CMD)

Year	Process	Cooling	Domestic	Total
2001	-	1.8 (41.86)	2.5 (58.13)	4.3 (100)
2002	-	1.5 (37.5)	2.5 (62.5)	4 (100)
2003	-	1.4 (38.83)	2.2 (61.17)	3.6 (100)
2004	-	1.3 (37.14)	2.2 (62.83)	3.5 (100)
2005	-	1.1 (35.48)	2 (64.51)	3.1 (100)
2006	-	1 33.35)	2 (66.66)	3 (100)
2007	-	1 (33.35)	2 (66.66)	3 (100)
2008	-	1 (33.35)	2 (66.66)	3 (100)
CGR	-	-8.34	-3.57	-5.35

Source : Environmental Statement Report of M/s Shree Kedar Metal Foundries Pvt. Ltd., for financial years 2001 to 2008.

Note : Figures in the brackets shows the percentage to total.

From the above table it is clear that Shree Kedar Metal Foundries Pvt. Ltd. did not consume any quantity of water for the

purpose of processing. Water consumption for cooling purpose was recorded at 1.8 CMD in 2001. Its percentage share was recorded at 41.86% of total water consumption. This quantity was reduced in 2008 and recorded at 1 CMD with percentage share of 33.33%. Water consumption for cooling purpose was reduced by 8.34%.

Likewise water consumption for domestic purposes also reduced by 3.5%, which was previously recorded at 2.5 CMD in 2001 with percentage share of 58.13%, reduced upto 2 CMD. The total water consumption was recorded at 4.3 CMD in 2001, which was also reduced in 5.35% and recorded at 3 CMD in 2008.

The above table also shows that Shree Kedar Metal Foundries Pvt. Ltd. has been consuming more water for domestic purpose. The percentage share also increased upto 66.66 in 2008 from 58.13% in 2001.

Quantity of water is used in cooling as well as in domestic purposes was higher than its permissible quantity. Hence, it is much necessary that they should try to reduce the extra quantity of water was it is consuming and it should compliance against MPCB norms.

There were higher standard deviations were found in total water consumption, whereas less standard deviations were found in domestic water consumption and cooling water consumption. There was a strong and positive correlation between cooling and total water consumption with r value of .990 was observed. Moreover, there was also strong and positive correlation with r value of .981 observed between domestic and total water consumption.

4.5.1.6.2 Raw Material Consumption

Pig iron, coal, CI scrap are the important raw materials for Shree Kedar Metal Foundries Pvt. Ltd., The yearwise consumption of such materials is given in Table No. 4.5.1.6.2.

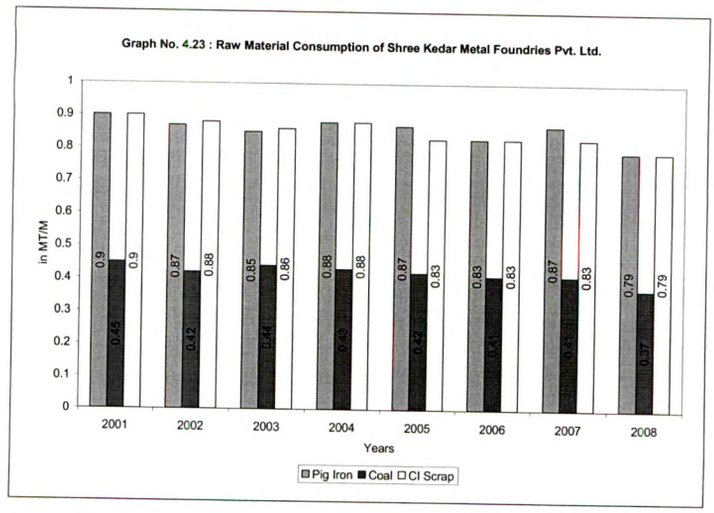
Table No. 4.5.1.6.2

Raw Material Consumption of Shree Kedar Metal Foundries Pvt. Ltd.

(in MT/M)

Name of the Raw Material	2001	2002	2003	2004	2005	2006	2007	2008	CGR
Pig Iron	0.9	0.87	0.85	0.88	0.87	0.83	0.87	0.79	-1.45
Coal	0.45	0.42	0.44	0.43	0.42	0.41	0.41	0.37	-2.03
CI Scrap	0.9	0.88	0.86	0.88	0.83	0.83	0.83	0.79	-1.61

Source : Same as of Table No. 4.5.1.6.1



In the above table consumption of pig iron was recycled at 0.9 MT/M in 2001, which reduced in 2008 and recorded at 0.79 MT/M. The consumption of pig iron was reduced by 1.45% during the study period. Likewise the consumption of coal and CI scrap also reduced by 2.03% and 1.63%, which were recorded at 0.45% and 0.9% in 2001 decreasingly recorded at 0.37 and 0.39% in 2008. In short, Shree Kedar Metal Foundries has become successful in reducing raw material consumption.

4.5.1.6.3 Pollution Discharge to Environment

An empirical analysis of pollution can be discussed in the following two parts.

a) Ambient Air Quality

Ambient air quality analysis gives the concentration figures in mg/Nm^3 in the environment. In the following table such concentration of figures of Shree Kedar Metal Foundries is given. The table No. 4.5.1.6.3 a shows the ambient air quality.

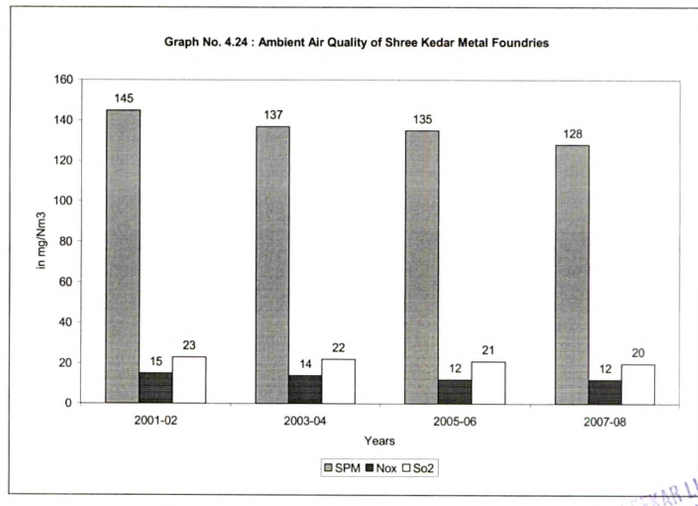
Table No. 4.5.1.6.3 a

Ambient Air Quality of Shree Kedar Metal Foundries Pvt. Ltd.

(mg/Nm^3)

Year	SPM	No_x	So_2
2001-02	145	15	23
2003-04	137	14	22
2005-06	135	12	21
2007-08	128	12	20
CGR	-3.81	-7.90	-4.55

Source : Same as of Table No. 4.5.1.6.1



In the above table, the concentration value of SPM was recorded at 145 mg/Nm^3 in 2001 and this reduced to 128 mg/Nm^3 2008. These values were reduced by 2.81%.

Likewise the concentration values of No_x and So_2 pollutants were also reduced by 7.90% and 4.55%, which recorded at 12 and 20 mg/Nm^3 in 2007-08 that were recorded at 15 and 23 mg/Nm^3 in 2001. The standard deviation recorded in the concentration of SPM was high and less standard deviation was in the concentration of No_x and So_2.

The above recorded concentration values are in the limits of MPCB. Hence, it can said that Shree Kedar Metal Foundries has been become successful in controlling air pollution and compliance against the MPCB norms.

b) Waste Water Quantity

Domestic waste water quantity is given in the following table.

Table No. 4.5.1.6.3 b

Waste Water Quantity of Shree Kedar Metal Foundries Pvt. Ltd.

(in CMD)

Year	Waste Water Quantity
2001-02	1.9
2003-04	1.7
2005-06	1.5
2007-08	1.4
CGR	-9.88

Source : Same as of Table No. 4.5.1.6.1

In the above table the domestic waste water quantity is given. Domestic waste water quantity was recorded at 1.9 CMD in 2001 and reduced to 1.4 CMD in 2008. The domestic waste water was reduced by 9.88%. Even though this reduced by 9.86%. The waste water quantity was still higher than its permissible water quantity, that

is 0.3 CMD. Hence, it is suggested that Shree Kedar Metal Foundries Pvt. Ltd. should try to reduce the waste water quantity and compliances against MPCB norms.

4.5.1.6.4 Hazardous Waste

Shree Kedar Metal Foundries Pvt. Ltd. is responsible for hazardous waste in the form of generation of process dust. The MPCB has given 100 kg per month as a maximum limit for generation of process dust. Against this, standardized limits actual generation of process dust is shown in the following table.

Table No. 4.5.1.6.4

Hazardous Waste of Shree Kedar Metal Foundries Pvt. Ltd.

(in kg)

Year	Process Dust
2001	55
2002	52.5
2003	52.7
2004	52
2005	51
2006	50
2007	52
2008	45
CGR	-2.15

Source : Same as of Table No. 4.5.1.6.1

In the above table, process dust generated by Shree Kedar Metal Foundries Pvt. Ltd. was recorded at 55 kg per month in 2001, which reduced to 45 kg in 2008. The generation of process dust was reduced by 2.15% and quantity of process dust was also under the limits of MPCB. Hence it can be said that Shree Kedar Metal Foundries Pvt. Ltd. compliances against hazardous waste by controlling process dust quantity.

4.5.1.6.5 Solid Waste

Shree Kedar Metal Foundries Pvt. Ltd. generates solid waste by the source of pollution control facilities and ETP sludge. The actual quantity of solid waste is shown in the following table.

Table No. 4.5.1.6.5

Solid Waste of Shree Kedar Metal Foundries Pvt. Ltd.

(in MT/M)

Solid Waste	2001	2002	2003	2004	2005	2006	2007	2008	CGR
From Process	-	-	-	-	-	-	-	-	-
From PCF & ETP Sludge	185	184	182	183	183	180	180	160	-1.37
Quantity Recycled	185	184	182	183	183	180	180	160	-1.37
Sold	-	-	-	-	-	-	-	-	-

Source : Same as of Table No. 4.5.1.6.1

From the above table it is clear that the solid waste generated by Shree Kedar Metal Foundries Pvt. Ltd. was recorded at 185 MT, which reduced by 1.37% during study period and recorded at 2160 MT in 2008. The same quantity was recycled in the production activity.

4.5.2 Environmental Auditing of Dairy Industries

A researcher has made an empirical analysis of environmental auditing practices of 4 dairy industries in the following sub sections.

4.5.2.1 Environmental Auditing of the Bombay Nagroai Milks Co- operative Society Ltd.

The practices of environmental auditing accepted by Bombay Nagroai milk co-operative society Ltd has been empirically analysed in following the sub-section.

4.5.2.1.1 Water consumption of Bombay Nagroai Milk Co-operative Societies

Like any other industry, water consumption of Bombay Nagroai Milk Co-operative Societies is given with following standards of the MPCB.

Process	40 m^3/day
Cooling	Nil
Domestic	10 m^3/day

Against these maximum limits of water consumption, actual water consumption is shown in following table.

Table 4.5.2.1.1

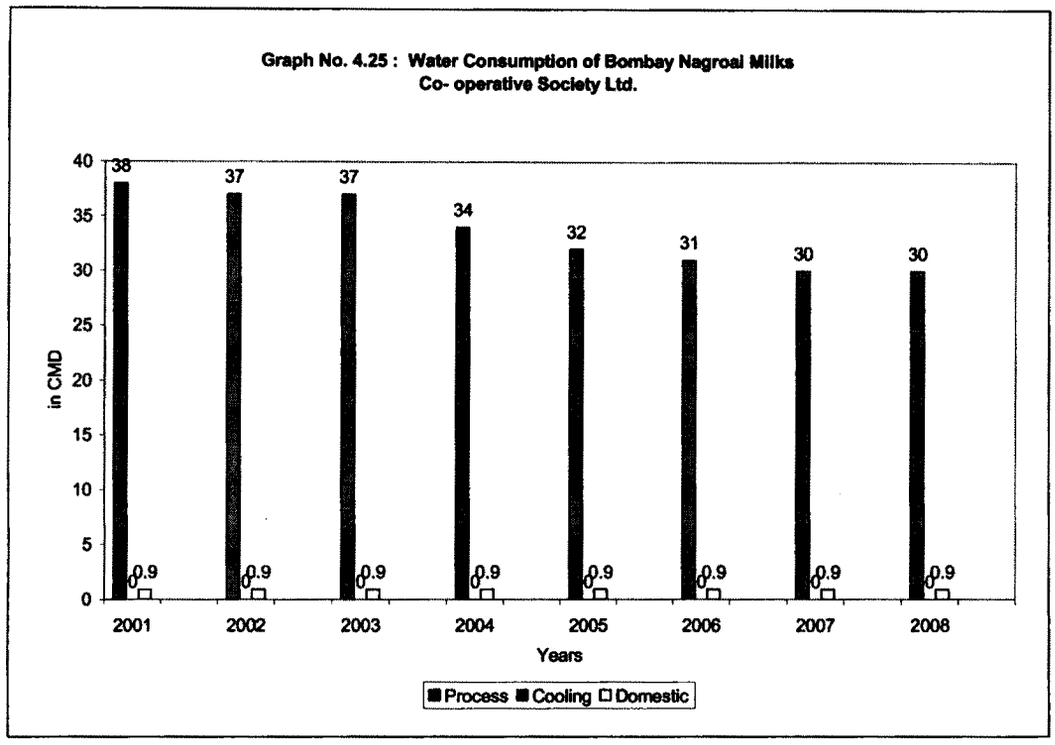
Water Consumption of Bombay Nagroai Milks Co- operative Society Ltd.

(in CMD)

Year	Process	Cooling	Domestic	Total
2001	38 (99.76)	-	0.9 (0.24)	38.09 (100)
2002	37 (99.76)	-	0.9 (0.24)	37.09 (100)
2003	37 (99.76	-	0.9 (0.24)	37.09 (100)
2004	34 (99.76)	-	0.9 (0.24)	34.09 (100)
2005	32 (99.76)	-	0.9 (0.24)	32.09 (100)
2006	31 (99.76)	-	0.9 (0.24)	31.09 (100)
2007	30 (99.76)	-	0.9 (0.24)	30.09 (100)
2008	30 (99.76)	-	0.9 (0.24)	30.09 (100)
CGR	-3.84	-	0	-3.83

Source : Environmental Statement Reports of Bombay Nagroai Co-operative Milk Ltd. for Financial years 2001-2008 submitted to MPCB Sangli.

Note : Figures in the brackets shows the percentage to total.



In the above table, water consumption of Bombay Nagroai Milk Co-operatives Societies during the study period is shown. In 2001 it consumed 38 m^3/day that reduced by 3.84% and it was recorded at 30 m^3/day in 2008. Where as for cooling purpose, it did not consumer any quantity of water. For Domestic purpose water consumption was recorded at 0.9 m3 day. The total water consumption was recorded at 38.09 m3| day in 2001, which reduced by 3.83% in 2008 and recorded at 30.09 m^3/day.

From the above table it is clear that, industry has consumed 99.76% of its total water for processing purpose, whereas domestic water consumption accounted for only 0.24% to the total water consumption.

4.5.2.1.2 a Raw material consumption

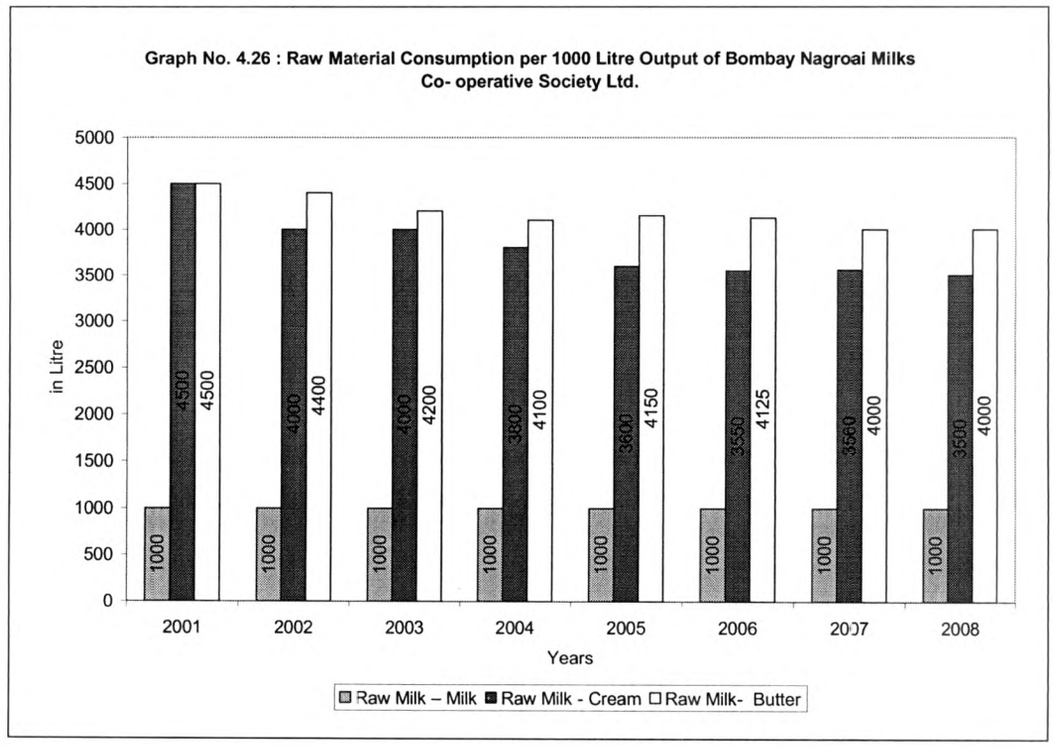
Raw milk is the only raw material for dairy industries. Productwise milk consumption is given in Table 4.5.2.1.2.

Table 4.5.2.1.2

Raw Material Consumption per 1000 Litre Output of Bombay Nagroai Milks Co- operative Society Ltd.

Name of the Raw Material Out	2001	2002	2003	2004	2005	2006	2007	2008	CGR
Raw Milk – Milk	1000	1000	1000	1000	1000	1000	1000	1000	-
Raw Milk - Cream	4500	4000	4000	3800	3600	3550	3560	3500	-3.21
Raw Milk- Butter	4500	4400	4200	4100	4150	4125	4000	4000	-1.58

Source : Same as of Table No. 4.5.2.1.1



The above table shows productwise raw material consumption per 1000 litre of output. In above table 1000 litre of raw milk was consumed per 1000 litre milk. In cream production 4500 litre raw milk was consumed for 1000 litre of cream.

In 2008 and the consumption of raw milk was reduced upto 3500. In 2001 to produce 1000 litre of cream production raw milk was reduced by 3.21% during the study period.

For the production of butter 4500 litre raw milk was consumed in 2001 and raw milk consumption was reduced by 1.58% and recorded at 4000 litre of raw milk.

In short, it has reduced the consumption of raw milk in the production of cream in 3.21% and in the production of Butter by 1.58%

b) Fuel and Energy Consumption

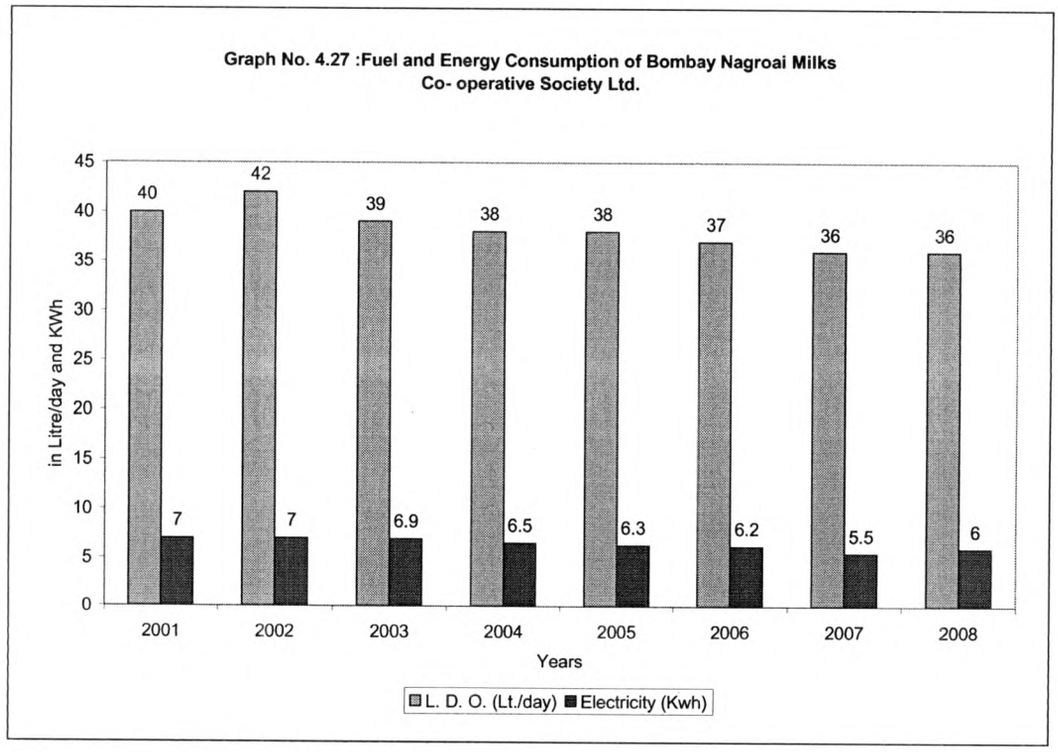
L. D. D. and electricity are two important fuel and energy resources for a dairy industries.

Table 4.5.2.1.3 b

Fuel and Energy Consumption of Bombay Nagroai Milks Co- operative Society Ltd.

Fuel Energy Consumption	2001	2002	2003	2004	2005	2006	2007	2008	CGR
L. D. O. (Lt./day)	40	42	39	38	38	37	36	36	-1.96
Electricity (Kwh)	7	7	6.9	6.5	6.3	6.2	5.5	6	-3.09

Source : Same as of Table No. 4.5.2.1.1



In the above table, the consumption of L. D. O. was recorded at 40 litre per day was reduced in 2008 and recorded at 36 litre. The consumption of LDO was reduced by 1.96% during the study

period. Likewise, the consumption of electricity was also reduced by 3.09% during the study period.

4.5.2.1.3 Pollution Discharge to Environment

This part of pollution discharge to the environment is shown in following two sections.

a) Ambient Air Quality

b) Waste Water Quality

4.5.2.1.3 a Ambient Air Quality

There is no air pollution of any kind was observed. The concentration of air and gaseous pollutants is shown in the following table.

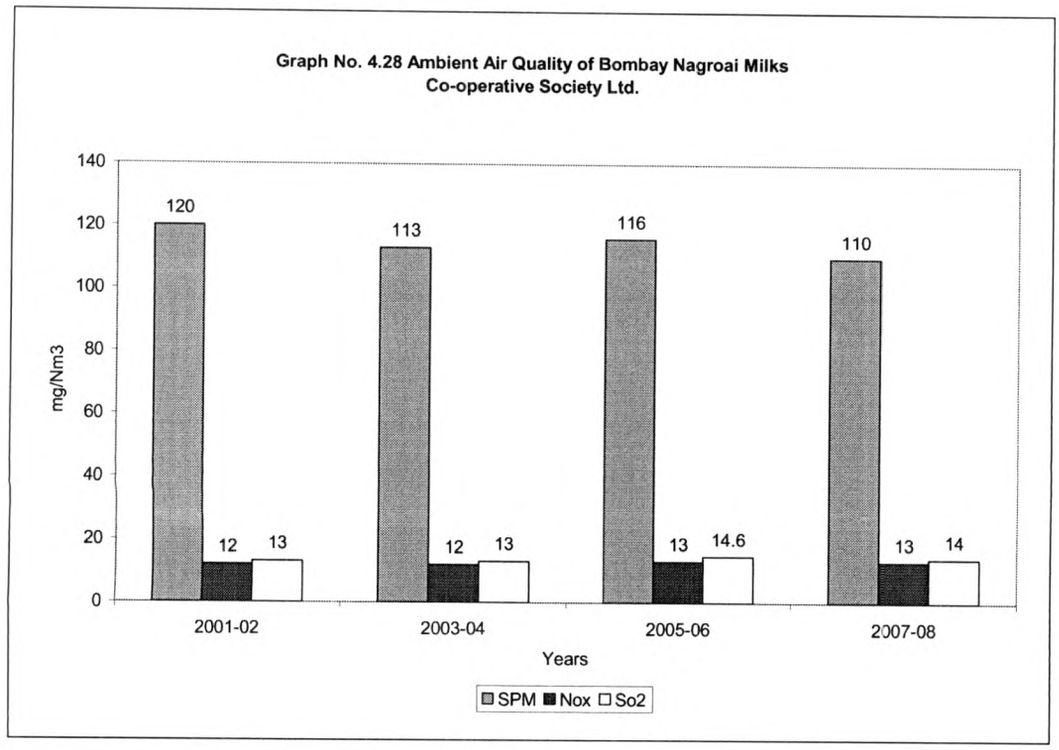
Table 4.5.2.1.4 a

Ambient Air Quality of Bombay Nagroai Milks Co- operative Society Ltd.

(mg/Nm^3)

Year	SPM	No_x	So_2
2001-02	120	12	13
2003-04	113	12	13
2005-06	116	13	14.6
2007-08	110	13	14
CGR	-2.32	3.25	3.44

Source : Same as of Table No. 4.5.2.1.1



In 2001-02 SPM was recorded at 120 mg/Nm^3 in 2007-2008. It is observed that SPM was reduced by 2.32%, whereas the values of other gaseous pollutants No_x and So_2 were increased in 3.25% and 2.44%. All concentration values were found to be in the limits of MPCB.

4.5.2.1.3 b Waste water Quantity

The industrial waste water quantity of Bombay Nagroai Milk Co-operative Society is shown in following table.

Table 4.5.21.3.b

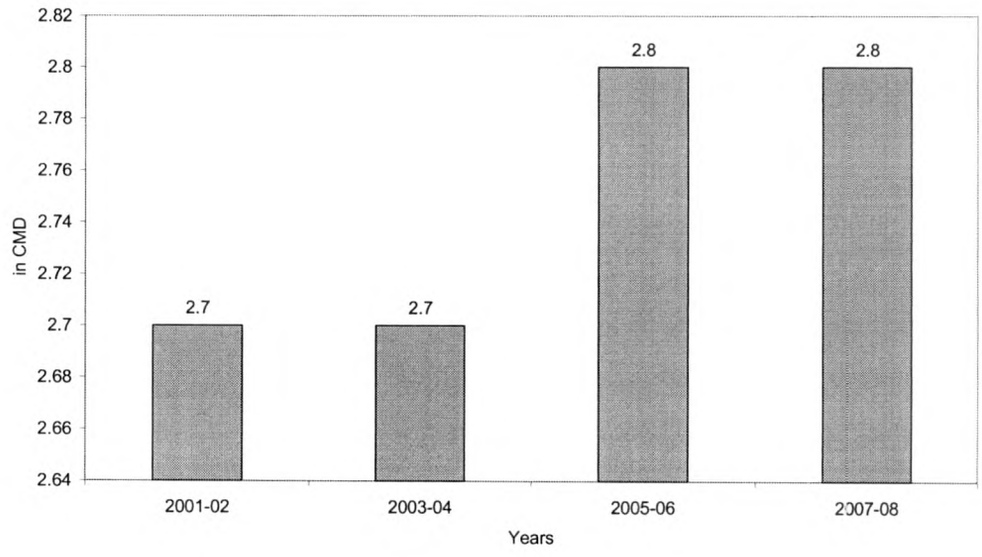
Waste Water Quantity of Bombay Nagroai Milks Co- operative Society Ltd.

(in CMD)

Year	Waste Water
2001-02	2.7
2003-04	2.7
2005-06	2.8
2007-08	2.8
CGR	1.46

Source : Same as of Table No. 4.5.2.1.1.1

Graph No. 4.29 :Waste Water Quantity of Bombay Nagroai Milks Co- operative Society Ltd.



In above table, waste water quantity recorded at 2.7 CMD in 2001, which slightly increased over the study period and recorded at 2.8 CMD in 2008 The compound growth rate for this was recorded at 1.46%. The above table also shows that it has generated waste water quantity within the limits of MPCB, that is 3 CMD.

4.5.2.1.3 Solid Waste

The Bombay Nagroai Milk Co-operative Societies generates solid waste from process. The following table gives details about solid waste.

Table 4.5.2.1.4

Solid Waste of Bombay Nagroai Milks Co- operative Society Ltd.

(in MT/M)

Solid Waste	2001	2002	2003	2004	2005	2006	2007	2008	CGR
From Process	3200	2990	2950	2700	2500	2300	2400	2400	-2.01
From PCF & ETP Sludge	-	-	-	-	-	-	-	-	-
Quantity Recycled	-	-	-	-	-	-	-	-	-
Disposed	3200	2990	2950	2700	2500	2300	2400	2400	-2.01

Source : Same as of Table No. 4.5.2.1.1

In the above table, solid waste generation was recorded at 3200 kg in 2001, which reduced up to 2400 kg in 2008 It has reduced solid waste generation by 20% during the study period.

4.5.2.2 Environmental Auditing of Ghansham Dairy

Empirical analysis of Ghansham Dairy is presented in the following sub- sections.

4.5.2.2.1 Water Consumption

Dairy industries consumes water per processing and domestic purposes only. It did not consume any quantity of water for cooling purposes.

The Maharashtra Pollution Control Board has given following conditions relating to water consumption.

Process	40 m^3/day
Cooling	Nil
Domestic	10 m^3/day

With these standardized limits the actual water consumption of Ghansham Dairy is shown in Table 4.5.2.2.1.

Table 4.5.2.2.1

Water Consumption of Ghansham Dairy

(in CMD)

Year	Process	Cooling	Domestic	Total
2001	20 (98.10)	-	0.40 (1.90)	20.40 (100)
2002	20 (98.10)	-	0.40 (1.90)	20.40 (100)
2003	20 (98.10)	-	0.40 (1.90)	20.40 (100)
2004	20 (98.10)	-	0.40 (1.90)	20.40 (100)
2005	20 (98.10)	-	0.40 (1.90)	20.40 (100)
2006	20 (98.10)	-	0.40 (1.90)	20.40 (100)
2007	20 (98.10)	-	0.40 (1.90)	20.40 (100)
2008	20 (98.10)	-	0.40 (1.90)	20.40 (100))
CGR	-	-	-	-

Source : Environmental Statement Reports of Ghansham Dairy for Financial years 2001-2008 submitted to MPCB Sangli.

Note : Figures in the brackets shows the percentage to total.

The above table gives the categorywise water consumption of Ghansham Diary products. in 2001, Ghansham Diary has consumed 20 m^3/day, which remained the same upto 2008. It contributed 98.10% share of total water consumption. water used for domestic purposes was recorded at 0.4 m^3/day in 2001, which also remained the same at 0.4 in 2008. It comprised only 1.90% of total water consumption. The total water consumption was recorded at 20.40 m^3/day in 2001, which remained same upto 2008. In the above table, all recorded values were in the limits of MPCB and Dairy has ensured compliance.

4.5.2.2.2 a Raw material consumption

Raw milk is the only raw material for dairy industries. Year and productwise consumption of Ghansham Diary is given in the following table.

Table 4.5.2.2.2 a

Raw Material Consumption per 1000 Litre Output of Ghansham Dairy

Name of the Raw Material Output	2001	2002	2003	2004	2005	2006	2007	2008	CGR
Raw Milk – Milk	1000	1000	1000	1000	1000	1000	1000	1000	-
Raw Milk Ghee	4000	4000	4000	4000	4000	4000	4000	4000	-

Source : Same as of Table No. 4.5.2.2.1

In the above table, the raw milk 1000 litre was consumed to produce 1000 litre of milk and 4000 litre raw milk was consumed for 1000 litre of ghee. The ratio remained the same for the study period.

4.5.2.2.2 b) Fuel and Energy Consumption

Ghansham Dairy consumes electricity as fuel and energy source. In the following table electricity consumption of Ghansham Dairy is given.

Table 4.5.2.2.2 b

Fuel and Energy Consumption of Ghansham Dairy

Fuel Energy Consumption	2001	2002	2003	2004	2005	2006	2007	2008	CGR
L. D. O. Lt./day	-	-	-	-	-	-	-	-	-
Electricity	50	47	44	40	40	38	37	35	-4.80

Source : Same as of Table No. 4.5.2.2.1

In the above table electricity consumption was recorded at 50 Kwh per month in 2001, which decreased in 2008 to 35 Kwh per month. In short, this consumption was increased by 4.80% during the study period.

4.5.2.2.3 Pollution Discharge to Environment

As far as dairy industries are concerned, their environmental auditing practices are shown in the following sections.

a) Ambient Air Quality

Dairy industries are very shortly responsible for air pollution. Concentration of air pollutants is shown in the following table.

Table 4.5.2.2.3 a

Ambient Air Quality of Ghansham Dairy

(mg/Nm^3)

Year	SPM	No_x	So_2
2001-02	122	11	11
2003-04	125.8	12	12
2005-06	128	14	12
2007-08	129	13.5	11
CGR	1.86	7.89	6.66

Source : Same as of Table No. 4.5.2.2.1

In the above table concentration of SPM, No_x and So_2 pollutants are given for 8 years of period. In 2001-02 concentration of SPM was reduced at 122 mg/Nm^3, which decreased to 129 mg/Nm^3. In this case, the concentration was increased by 1.88%, whereas concentration values of No_x and So_2 were decreased fastly by 7.89% and 6.66%. There was also less standard deviation recorded in concentration values of No_x and So_2, whereas comparatively high standard deviation was recorded in the concentration of SPM.

b) Waste Water Quantity

Dairy industries are responsible for pollution in the case of only waste water quantity. This is shown in Table No. 4.5.2.2.3 b.

Table No. 4.5.2.2.3 b

Waste Water Quantity of Ghansham Dairy

(in CMD)

Year	Waste Water Quantity
2001-02	20
2003-04	20
2005-06	18
2007-08	18
CGR	-4.26

Source : Same as of Table No. 4.5.2.2.1

In the above table industrial waste water quantity was recorded at 20 m^3/day in 2001, which was reduced, by 18 m^3/day in 2008. This waste water quantity was higher than its maximum quantities, which was 2 m^3/day. Hence it is suggested that industry should reduce the waste water quantity and it should compliance against the MPCB norms.

4.5.2.3 Environmental Auditing of Hamma Dairy

An empirical analysis of Hamma Dairy is presented in following sub- sections.

4.5.2.3.1 Water Consumption

As far as dairy industries are concerned, Hamma Dairy did not consume any quantity of water for cooling purpose, for process and domestic. The Maharashtra Pollution Control Board has given following conditions relating to water consumption.

Process	40 m^3/day
Cooling	Nil
Domestic	10 m^3/day

Against these standardized limits, the actual consumption of Hamma Dairy is shown in the Table No. 4.5.2.2.1.

Table 4.5.2.2.1

Water Consumption of Hamma Dairy

(in m^3/day)

Year	Process	Cooling	Domestic	Total
2001	8 (95.23)	-	0.4 (4.76)	8.4 (100)
2002	8 (95.23)	-	0.4 (4.76)	8.4 (100)
2003	6 (95.23)	-	0.3 (4.76)	6.3 (100)
2004	7 (95.23)	-	0.3 (4.76)	7.3 (100)
2005	8 (95.23)	-	0.4 (4.76)	8.4 (100)
2006	1 (66.66)	-	0.5 (33.35)	1.5 (100)
2007	1 (66.66)	-	0.5 (33.35)	1.5 (100)
2008	3 (88.23)	-	0.4 (11.76)	3.4 (100)
CGR	-23.50		3.55	32.70

Source : Environmental Statement Reports of Hamma Dairy Pvt. Ltd. for Financial years 2001-2008 submitted to MPCB Sangli.

Note : Figures in the brackets shows the percentage to total.

In 2001, Hamma Dairy has consumed 8 m^3/day water for processing purpose and percentage share of processing water consumption was recorded at 95.23 in 2001. However, in the next 8 years processing water consumption fell upto 1 m^3/day and its percentage share also decreased upto 88.23%. The net decline in processing water consumption was recorded at 23.50%.

Whereas domestic water consumption was recorded at 0.4 m^3/day in 2001, which increased by 3.55% over the study period. The total water consumption was recorded at 8.4 m^3/day in 2001 which reduced by 32.70%. There was less deviation found in processing and

total water consumption, whereas comparatively high or more standard deviations were recorded in domestic water consumption.

4.5.2.3.2 a Raw material consumption

As far as dairy industries are concerned, raw milk is only source of raw material. Productwise raw material consumption is given in the following table.

Table 4.5.2.3.2 a

Raw Material Consumption of Hamma Dairy

m^3/day

Name of the Raw Material Output	2001	2002	2003	2004	2005	2006	2007	2008	CGR
Raw Milk – Milk	1000	1000	1000	1000	1000	1000	1000	1000	-
Raw Milk - Cream	4000	4000	4000	4000	4000	4000	4000	4000	-
Raw Milk Butter	4000	4000	4000	4000	4000	4000	4000	4000	-

Source : Same as of Table No. 4.5.2.3.2

The above table shows that 1000 litre of raw milk was used for 1000 litre of milk, whereas 4000 litre of raw milk was consumed for 1000 litre of cream and 4000 litre of raw milk was used for producing 1000 litre of butter.

4.5.2.3.2 b) Fuel and Energy Consumption

Hamma Dairy Pvt. Ltd. consumes LDO and electricity in its processing activities. For LDO consumption MPCB has given 10 litres as a maximum limit of consumption. Against this maximum limit, the actual consumption of above fuel and energy sources is shown in the following table.

Table 4.5.2.3.2 b

Fuel and Energy Consumption of Hamma Dairy

Fuel Energy Consumption	2001	2002	2003	2004	2005	2006	2007	2008	CGR
L. D. O. Lt./day	1	1	1	1	1	1	1	1	-
Electricity	0.164	0.123	0.12	0.115	1.111	0.109	0.105	1	-1.7

Source : Same as of Table No. 4.5.2.3.1

The above table shows that the consumption of LDO was 1 litre per day in 3001, which remained the same upto 2008. Whereas electricity consumption was recorded at 0.164 Kwh per month in 2001 that reduced upto 1 Kwh per month in 2008. The decline of electricity consumption was recorded at 1.29%.

In short, Hamma Dairy has reduced fuel and energy consumption in the study period.

4.5.2.3.3 Pollution Discharge to Environment

Pollution discharge practices of diary industries are empirically analysed in the following sub sections.

a) Ambient Air Quality

Ambient air quality and its parameters are less important for dairy industries. Against this MPCB standard of 150 mg/Nm^3 the actual concentration of SPM is shown in the Table No. 4.5.21.3.3 a.

Table 4.5.2.3.3 a
Ambient Air Quality of Hamma Dairy

(mg/Nm^3)

Year	SPM	No_x	So_2
2001-02	130	10	12
2003-04	125	12	14
2005-06	75	6	6.5
2007-08	62.5	18.5	20
CGR	-22.64	12.21	7.95

Source : Same as of Table No. 4.5.2.3.1

In 2001, the actual concentration of SPM was found at 130 mg/Nm^3, which has reduced by 22.64% and recorded at 65.5 mg/Nm^3 in 2008, whereas No_x and So_2 were the gaseous pollutants, which reduced their concentration during the 8 years of study period by 12.6% and 7.95%

All parameters were found within the limit of MPCB. There was also high standard deviation i. e. 33.34 in the concentration of SPM and standard deviation in No_x and So_2 concentration were found less.

b) Waste Water Quality

Domestic waste water quantities are given in the following table.

Table No. 4.5.2.3.3 b

Waste Water Quantity of Hamma Dairy

(in CMD)

Year	Waste Water
2001-02	2
2003-04	3
2005-06	5
2007-08	2
CGR	5.24

Source : Same as of Table No. 4.5.2.3.1

In the above table, in 2001-02 industrial waste water quantity recorded at 2 m^3/day, which was increased by CGR of 5.24% during the study period and recorded at 5 m^3/day in 2005-06.

From the above table it is clear that except 2006 domestic waste water quantity was in the limits of MPCB and has succeeded in keeping domestic waste water quantity within the limits of MPCB.

4.5.2.4 Environmental Auditing of Ram Vishwas Milk Products Pvt. Ltd.

Like above analysis of dairy industry, environmental auditing practices of Ram Vishwas Milk Products Pvt. Ltd. have been described below.

4.5.2.4.1 Water Consumption

Ram Vishwas Milk Products Pvt. Ltd. produces along with milk, khawa, chakka and basundi. Therefore, it needs water for cooling purposes also. The categorywise water consumption is shown in the following table.

Table 4.5.2.4.1
Water Consumption of Ram Vishwas Milk Products Pvt. Ltd.

(in m^3/day)

Year	Process	Cooling	Domestic	Total
2001	25 (91.23)	1 (7.80)	1.25 (4.76)	27.25 (100)
2002	25 (92.08)	0.95 (4.91)	1.2 (4.41)	27.15 (100)
2003	24 (92.30)	0.85 (3.20)	1.15 (4.42)	26 (100)
2004	23 (92.51)	0.75 (3.41)	1.11 (4.65)	24.86 (100)
2005	22 (10.34)	0.45 (1.84)	1.9 (7.80)	24.35 (100)
2006	21 (91.90)	0.35 (1.53)	1.5 (6.58)	22.85 (100)
2007	20 (91.53)	0.25 (1.12)	1 (4.58)	21.85 (100)
2008	20 (91.53)	0.25 (1.12)	1 (4.58)	21.85 (100)
CGR	-3.64	-17.93	-1.34	-3.63

Source : Environmental Statement Reports of Ram Vishwas Milk Products Pvt. Ltd. for Financial years 2001-2008 submitted to MPCB Sangli.

In the above table process water consumption was recorded at 25 m^3/day, which reduced in 2008 at 20 m^3/day. The net decline in process water consumption was recorded at 3.64% during the 8 years of study period. The percentage share of process water consumption was recorded at 91.23% of the total water consumption, which was slightly reduced over the period. It can be said that the percentage share of processing water was dominant factor in total water consumption.

Likewise, in 2001, industry has consumed 1 m^3/day water for cooling purpose and this quantity was reduced by 17.93 during the study period and recorded at 0.25 m^3/day in 2008. The percentage share of cooling water consumption stood at 3.80%, which fell in 2008 and recorded at 1.17% to total water consumption.

Likewise, domestic water consumption was recorded at 1.25 m^3/day in 2001 and its percentage share recorded at 4.80 of the total water consumption. Domestic water consumption seen to be fell in 2008 and recorded at 1 CMD.

The total water consumption was recorded at 27.25 m^3/day in 2001, which reduced over the years by 3.63% and recorded at 2.185 m^3/day in 2008. There was more standard deviations found for process water consumption and total water consumption. Moreover, comparatively less standard deviations were found for cooling and domestic water consumption. There is strong positive correlation found between process and total with r value of .994 and cooling. Likewise moderate correlation is found between process and domestic with r.047 and weak domestic and total with r value of .156.

4.5.2.4.2 a Raw material consumption

Ram Vishwas Milk Products Pvt. Ltd. consumes raw milk for producing milk chakka, khawa and basundi, whereas raw water is also used for ice production. The productwise consumption of raw material consumption is given in the following table.

Table 4.5.2.4.2 a

Raw Material Consumption of Ram Vishwas Milk Products Pvt. Ltd.

(m^3/day)

Name of the Raw Material Output	2001	2002	2003	2004	2005	2006	2007	2008	CGR
Raw Milk – Milk	1000	1000	1000	1000	1000	1000	1000	1000	-
Raw Milk Chakka	4000	3956	3945	3933	3917	3880	3809.5	3810.5	-0.69
Raw Milk Basundi	2810	2825	2840	2855	2865	2870	2886	2882.2	3.15
Raw Milk Ice	1230	1190	1160	1145	1135	1100	1000	1000	-2.91

Source : Same as of Table No. 4.5.2.4.1

In the above table it is shown that for producing 1000 litre of chakka and basundi this dairy has consumed 4000 and 2810 litre raw milk and the ratio was reduced in 2008 by 0.69 and 3.15% and recorded at 3810.5. The raw milk used in basundi was increased

by 3.15 and recorded at 2882.2 litre in 2008. Whereas for producing ice, dairy has consumed 1230 litre of raw water, which was reduced by 2.91 and recorded at 1000 litre.

In short, Ram Vishwas Milk Products Pvt. Ltd. has reduced the raw material consumption during the study period.

4.5.2.4.2 b) Fuel and Energy Consumption

Ram Vishwas Milk Products has LDO and electricity are the important sources of energy and fuel resources. In the following table consumption of such fuel and energy sources is shown.

Table 4.5.2.4.2 b

Fuel and Energy Consumption of Ram Vishwas Milk Products Pvt. Ltd.

Fuel Energy Consumption	2001	2002	2003	2004	2005	2006	2007	2008	CGR
L. D. O. Lt./day	40	42	39	38	38	37	36	36	-1.96
Electricity	7	7	6.9	6.5	6.3	6.2	5.5	6	-3.09

Source : Same as of Table No. 4.5.2.4.1

In the above table LDO was consumed at 40 litre per day that reduced to 36 litre per day in 2008. The net decline in LDO consumption was recorded about 1.96 over the years, and electricity consumption was recorded at 7 Kwh per month in 2001, which reduced in years by 3.09% and recorded at 6 Kwh per month in 2008. In short dairy has reduced its energy and fuel consumption also.

4.5.2.3 Pollution Discharge to Environment

As far as dairy industries are concerned, their pollution activities and their analysis is given below.

a) Ambient Air Quality

Ram Vishwas Milk Products Pvt. Ltd. generated air pollutants and their concentration is shown in Table 4.5.2.5.3 a.

Table 4.5.2.5.3 a

Ambient Air Quality of Ram Vishwas Milk Products Pvt. Ltd.

(mg/Nm^3)

Year	SPM	No_x	So_2
2001-02	107	10	13
2003-04	106	12	15
2005-06	103	13	14
2007-08	102	10	12
CGR	-1.7	0.80	-0.85

Source : Same as of Table No. 4.5.2.3.1

In the above table the concentration values of SPM were reduced by 1.7% and So_2 value by 0.85%, whereas No_x concentration values were slightly increased by 0.80% over the years. There was more or high standard deviations found in SPM concentration but comparatively low or less in So_2 and No_x concentration .

b) Waste Water Quantity

Ram Vishwas Milk Products generates its waste water in the following quantities. In Table No. 4.5.2.5.3 b the waste waster quantity is given.

Table No. 4.5.2.5.3 b

Waste Water Quantity of Ram Vishwas Milk Products Pvt. Ltd.

(in CMD)

Year	Waste Water
2001-02	19
2003-04	18.5
2005-06	18.3
2007-08	18.8
CGR	-0.42

Source : Same as of Table No. 4.5.2.5.1

In the above table waste water quantity is shown. In 2001 Ram Vishwas Milk Products has generated 19 CMD water and in next 8 years period it reduced upto just 18.8 CMD. From the above table

it can be said that it has reduced its waste water quantity by 0.42% during the study period. However, it should compliance against MPCB norms relating to waste water, that is 0.3 CMD of waste water.

4.5.2.5 Environmental Auditing of Chemical and Pharmaceutical Industries

Along with sugar industries, foundry and CI casting alloys, dairy industry researcher has also analysed empirical analysis of two chemical and one pharmaceutical industries in the following sub sections.

4.5.3.1 Environmental Auditing of M/s Shree Petro Chem

Environmental auditing of Shree Petro Chem has presented in the following sub sections.

4.5.3.1.1 Water Consumption

This part consist of quantity of water consumed per day, water balance, waste water generation, effluent treatment plants details, methods of disposal, deviations of effluent quantity to the norms, details of consent to water. [9]

The categorywise water consumption is given in following table.

Table No. 4.5.3.1.1

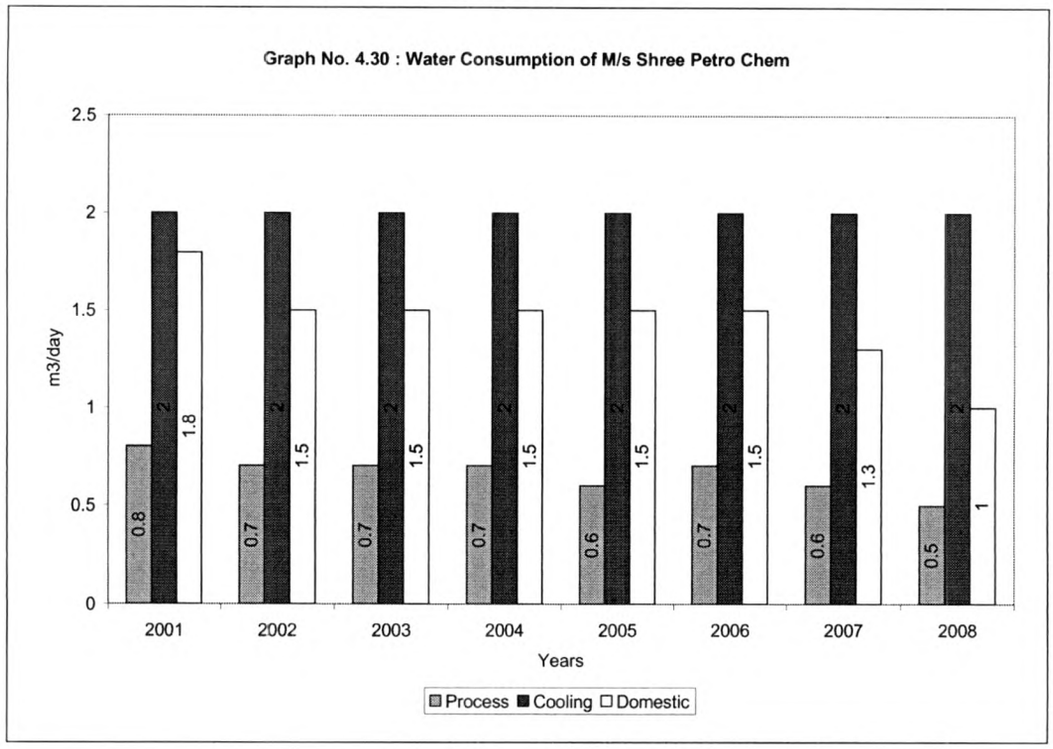
Water Consumption of M/s Shree Petro Chem

(in m^3/day)

Year	Process	Cooling	Domestic	Total
2001	0.8 (17.39)	2 (43.47)	1.8 (39.13)	4.6 (100)
2002	0.7 (16.66)	2 (47.6)	1.5 (35.71)	4.2 (100)
2003	0.7 (16.66)	2 (47.6)	1.5 (35.71)	4.2 (100)
2004	0.7 (16.66)	2 (47.6)	1.5 (35.71)	4.2 (100)
2005	0.6 (16.63)	2 (48.78)	1.5 (36.58)	4.1 (100)

Year	Process	Cooling	Domestic	Total
2006	0.7 (16.27)	2 (46.51)	1.5 (37.80)	4.3 (100)
2007	0.6 (15.58)	2 (51.28)	1.3 (33.33)	3.9 (100)
2008	0.5 (15.63)	2 (62.5)	1 (31.25)	3.2 (100)
CGR	-4.89	-	-5.36	-3.43

Source : Environmental Statement Reports of M/s Shree Petro Chem for Financial years 2001-2008 submitted to MPCB Sangli.



In the above table, processes water consumption was recorded at 0.8 m^3/day with percentage share of 17.39% of the total water consumption in 2001, which reduced to 0.5 m^3/day, and percentage share recorded at 15.62% of the total water consumption. Cooling water consumption was recorded at 2 m^3/day with percentage share of 43.47%, which remained the same for study period. Whereas domestic water consumption was recorded at 1.8 m^3/day with percentage share of 39.13 in the total water consumption in 2001 and reduced to 1 m^3./day in 2008 and percentage share was recoded at 31.25%. The domestic water consumption was reduced by 5.36%.

The total water consumption was recorded at 4.6 m^3/day in 2001, which reduced at 3.2 m^3/day in 2008. The total water consumption was reduced by 3.43% during the study period. There was strong positive correlation with r value of .939 between process and total water consumption.

4.5.3.1.2 Raw Material Consumption

Used transformer oil, reclaimed transformer, LDO oil, caustic soda, fullers earth, sulphuric acid are the important raw materials for Shree Petro Chem. The yearwise consumption of raw materials is given in the following table.

Table No. 4.5.3.1.2

Raw Material Consumption of M/s Shree Petro Chem

(kg)

Name of the Raw Material	2001	2002	2003	2004	2005	2006	2007	2008	CGR
Used Transformer Oil	133355	1333	1333	1333	1330	1331	1289	265	-58.44
Reclaimed Transformer Oil	1000	1000	985	980	965	655	940	925	-2.46
LDO Oil	16	16	15	14	12	11	11.5	10	-6.92
Caustic Soda	0.83	0.87	0.82	0.82	0.8	0.8	0.78	0.77	-1.10
Fullers Earth,	16.67	16.67	16.50	16.5	16.5	16	15.8	15.75	-0.50
Sulphuric Acid	100	100	95	95	87	86	85	85	-2.68

Source : Same as of Table No. 4.5.3.1.1

The table No. 4.5.3.1.2 shows that the used transformer oil was an important raw material whose consumption was recorded at 1333 kg in 2001 which reduced to 1265.2 kg in 2008. The net decline in consumption of used transformer oil was recorded at 58.44 during the study period. Likewise, reclaimed transformer was another raw material and consumption of this material was recorded at 100 kg in 2001, which was reduced in 2.46 and recorded at 925 kg in 2008. In a same way consumption of LDO caustic soda, fullers earth and sulphuric acid declined by 6.92, 1.10, 0.90 and 2.63% during the study period.

In short, Shree Petro Chem. Has succeeded in reducing raw material consumption over the study period.

4.5.3.1.3 Pollution Discharge to Environment

The empirical analysis of pollution discharge is as follows.

a) Ambient Air Quality

The ambient air quality of Shree Petro Chem is given in the following table.

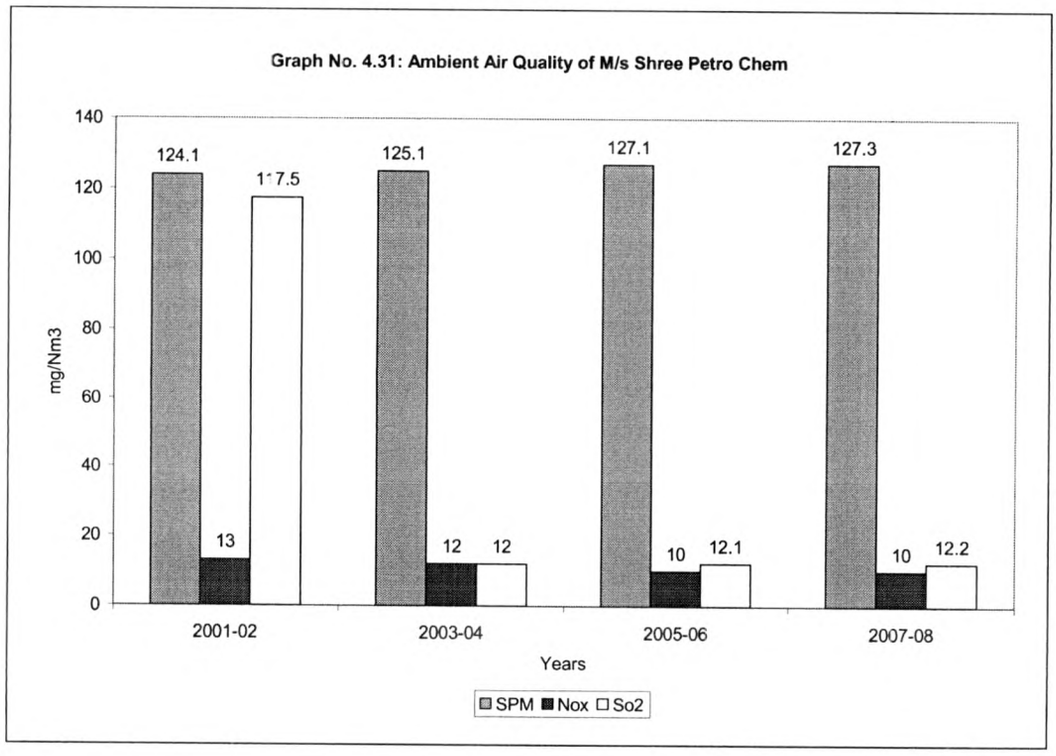
Table 4.5.3.1.3 a

Ambient Air Quality of M/s Shree Petro Chem

(mg/Nm^3)

Year	SPM	No_x	So_2
2001-02	124.1	13	117.5
2003-04	125.1	12	12
2005-06	127.1	10	12.1
2007-08	127.3	10	12.2
CGR	0.92	-9.23	1.21

Source : Same as of Table No. 4.5.3.1.1



In the above table SPM was recorded at 124.1 mg/Nm^3 in 2001-02, which increased to 127 mg/Nm^3 in 2007-08. The SPM increased was 0.92% whereas No_x concentration was recorded at 13 mg/Nm^3 in 2001-02 and was seen reduced by 9.23% and recorded at 9.23 mg/Nm^3. Likewise So_2 concentration was also reduced in 1.21% during the study period.

b) Waste Water Quality

Waste water generated by Shree Petro Chem is shown in the following table.

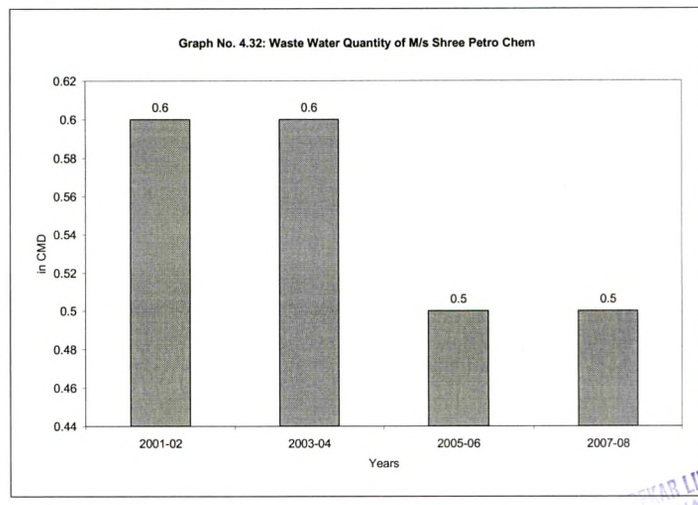
Table No. 4.5.3.1.3 b

Waste Water Quantity of M/s Shree Petro Chem

(in CMD)

Year	Waste Water
2001-02	0.6
2003-04	0.6
2005-06	0.5
2007-08	0.5
CGR	-1.03

Source : Same as of Table No. 4.5.3.1.1



In the above table, waste water generated by Shree Petro Chem was recorded at 0.6 CMD in 2001, which reduced upto 0.5 CMD for the study period. The waste water reduced by 1.03% during the study period.

4.5.3.1.4 Hazardous Waste

Hazardous waste generated by Shree Petro Chem is shown in the following table.

Table No. 4.5.3.1.4

Hazardous Waste of M/s Shree Petro Chem

(in kg.)

Hazardous Waste	2001	2002	2003	2004	2005	2006	2007	2008	CGR
From Processes	155	152	150	150	148	149	147	145	-0.42
From PCF & ETP Sludge	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	-

Source : Same as of Table No. 4.5.3.1.1

From the above table it can be said that Shree Petro Chem. is generating hazardous waste from process only. Hazardous was generated was recorded at 155 kg in 2001, which reduced to 145 kg in 2008. The net decline was recorded at 0.42 during the study period.

4.5.3.2 Environmental Auditing of Subhadra Petro Chemicals

The practices of environmental auditing of M/s Subhadra Petro Chemicals are empirically analysed in following sub sections.

Table No. 4.5.3.2.1

Water Consumption of M/s Subhadra Petro Chemicals

(in CMD)

Year	Process	Cooling	Domestic	Total
2001	Nil	2.30 (96.60)	0.8 (3.40)	2.38 (100)
2002	Nil	2.45 (96.83)	0.8 (3.17)	2.57 (100)
2003	Nil	3.25 (97.30)	0.9 (2.70)	3.24 (100)
2004	Nil	2.90 (97.64)	0.7 (2.21	2.97 (100)
2005	Nil	3.10 (97.79)	0.7 (2.21)	3.17 (100)
2006	Nil	2.96 (97.35)	0.8 (2.65)	3.03 (100)
2007	Nil	2.98 (98.67)	0.5 (1.33)	3.02 (100)
2008	Nil	5.39 (96.89)	0.6 (1.11)	5.45 (100)
CGR	Nil	8.18	-5.46	7.76

Source : Environmental Statement Reports of M/s Subhadra Petro Chemicals for Financial years 2001-2008 submitted to MPCB Sangli.

Note : Figures in the brackets shows the percentage to total.

From the above table it is clear that for processing purpose M/s Subhadra Petro Chemicals did not consume any quantity of water. For cooling purpose it has consumed 2.30 CMD water in 2001 and consumption increased in 2008 to 5.39 CMD. The net increase in this purpose of water consumption was recorded at 8.18% during study period. The percentage share of cooling water consumption stood at 96.60% in 2001, which slightly increased to 98.89% in 2008 whereas the domestic water consumption was recorded at 0.8 CMD in 2001, which reduced by 5.46% over the study period and recorded at 0.6 CMD. The percentage share of domestic water consumption was 3.40% of total water consumption in 2001, which fell to 1.11% in 2008.

The total water consumption of M/s Subhadra Petro Chemicals was recorded at 2.38 CMD in 2001, which increased upto 5.95 CMD during the study period. There were high/more standard deviations

found in cooling and total water consumption, whereas comparatively less or low standard deviations were found in domestic water consumption.

There was moderate negative correlation with r value of .407 was found between cooling and domestic water consumption. Likewise there was also moderate negative correlation with r value of .392 is found in domestic and total water consumption.

4.5.3.2.2 Raw Material Consumption

M/s Subhadra Petro Chemicals is engaged in producing transformer oil and oil residue, dolomite powder, hydrated lime, soap oil and sodium hydrate are the important raw materials of M/s Subhadra Petro Chemicals. The following table gives yearwise consumption of such materials.

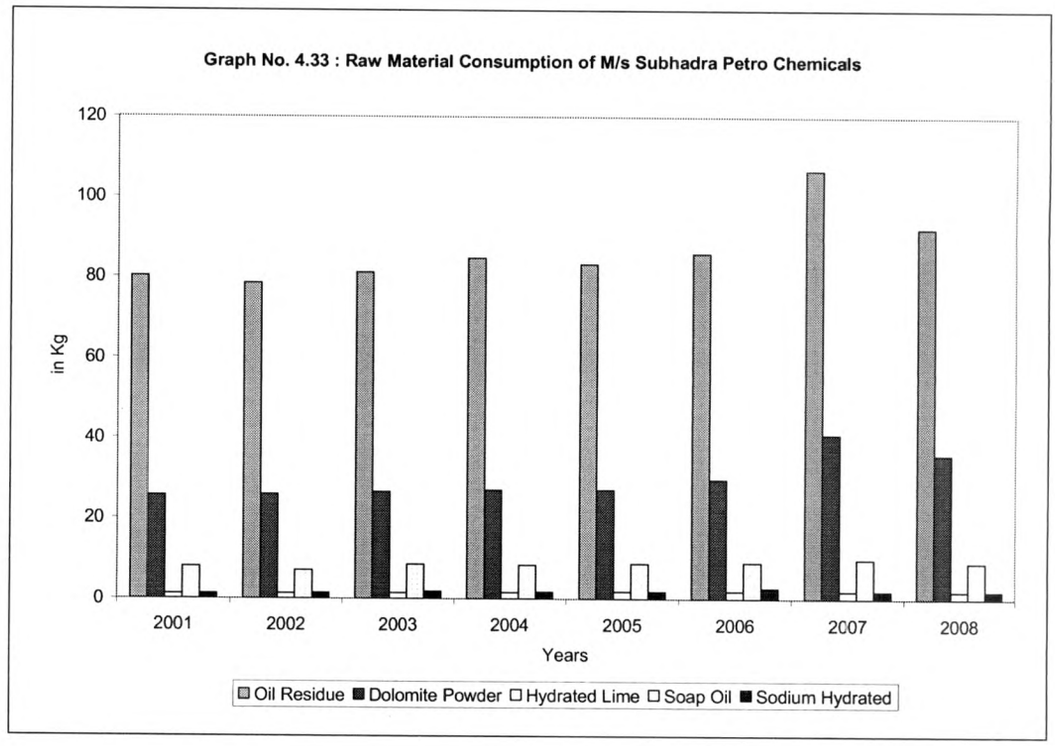
Table No. 4.5.3.2.2

Raw Material Consumption of M/s Subhadra Petro Chemicals

(kg per year)

Name of the Raw Material	2001	2002	2003	2004	2005	2006	2007	2008	CGR
Oil Residue	80.23	78.50	81.15	84.75	83.30	85.90	106.75	92.30	3.56
Dolomite Powder	25.5	25.80	26.40	26.90	27.00	29.50	40.82	35.68	6.47
Hydrated Lime	1.15	1.25	1.40	1.65	1.85	1.90	1.95	1.95	9.84
Soap Oil	8.0	7.0	8.5	8.3	8.8	9.0	9.8	9.0	4.03
Sodium Hydrated	1.25	1.40	1.85	1.80	1.85	2.73	1.95	1.95	6.96

Source : Same as of Table No. 4.5.3.2.1



From the above table it is clear that residue oil and dolomite powder are the predominant raw material for M/s Subhadra Petro Chemicals. In the above table No. 4.5.3.2.2, the consumption of oil residue was recorded at 80.23 kg. per year in 2001, which increased upto 106.15 kg per year in 2008. The increase in oil residue was recorded at 3.58. Likewise, dolomite powder was consumed in 2001 at 25.50 kg. moreover, increasingly consumed at 40 kg per year in 2008. The net increase in powder consumption was recorded at 6.47 during the study period. Likewise, the consumption of hydrated lime also increased by 9.84 during the study period, which was previously recorded at 1.15 kg in 2001 and increased to 2.23 kg in 2008. Likewise, the consumption of soap oil and sodium hydrated also seen to be increased by 4.03 and 6.96 during the study period.

In short, taking into consideration the above raw material consumption, it is clear that there is increasing trend in all type of raw material consumption. Hence, it was suggested to reduce its raw material consumption.

b) Energy Consumption

The following table shows the consumption of M/s Subhadra Petro Chemicals.

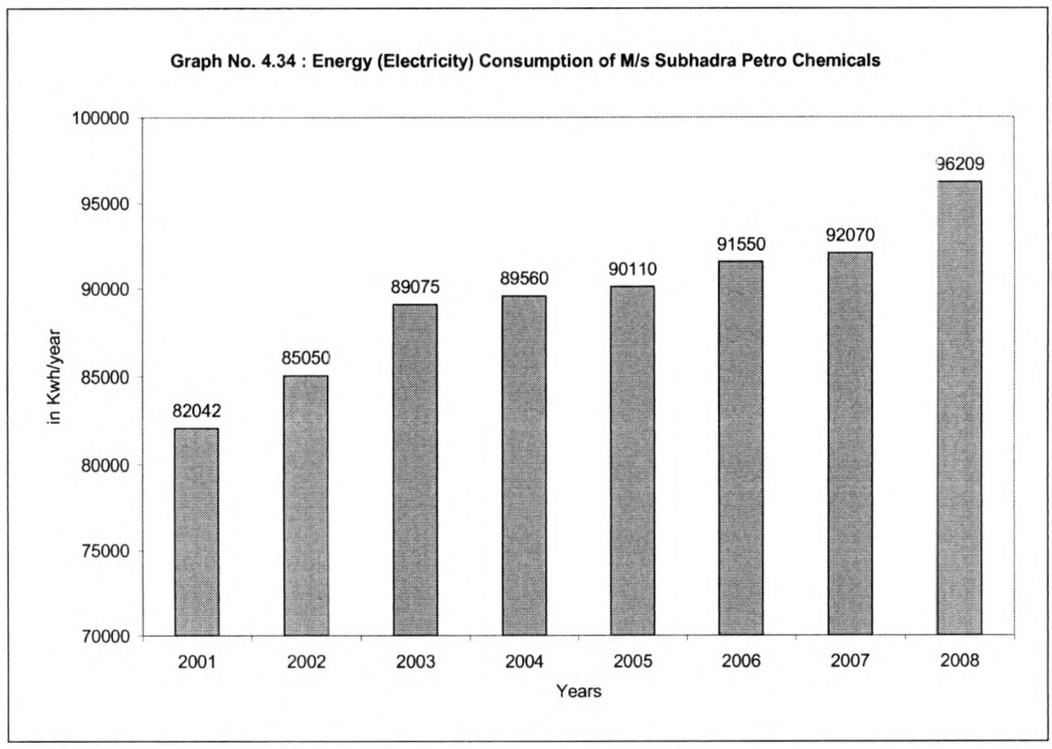
Table No. 4.5.3.2.2 b

Energy Consumption of M/s Subhadra Petro Chemicals

(Kwh/year)

Year	Electricity
2001	82042
2002	85050
2003	89075
2004	89560
2005	90110
2006	91550
2007	92070
2008	96209
CGR	1.92

Source : Same as of Table No. 4.5.3.2.1



In the above table electricity is the only source of energy consumption for M/s Subhadra Petro Chemicals. In 2001, electricity consumption was recorded at 82042 Kwh and it increased in 1.92% in 2008 and recorded at 96209 Kwh.

4.5.3.2.3 Pollution Discharge to Environment

Pollution activities and compliance of M/s Subhadra Petro Chemicals empirically has been analysed in the following sub section.

a) Ambient Air Quality

Ambient air quality analysis gives compliance of industrial units against MPCB norms, that is SPM should not exceed 150 mg/Nm^3. The following table shows ambient air quality of M/s Subhadra Petro Chemicals.

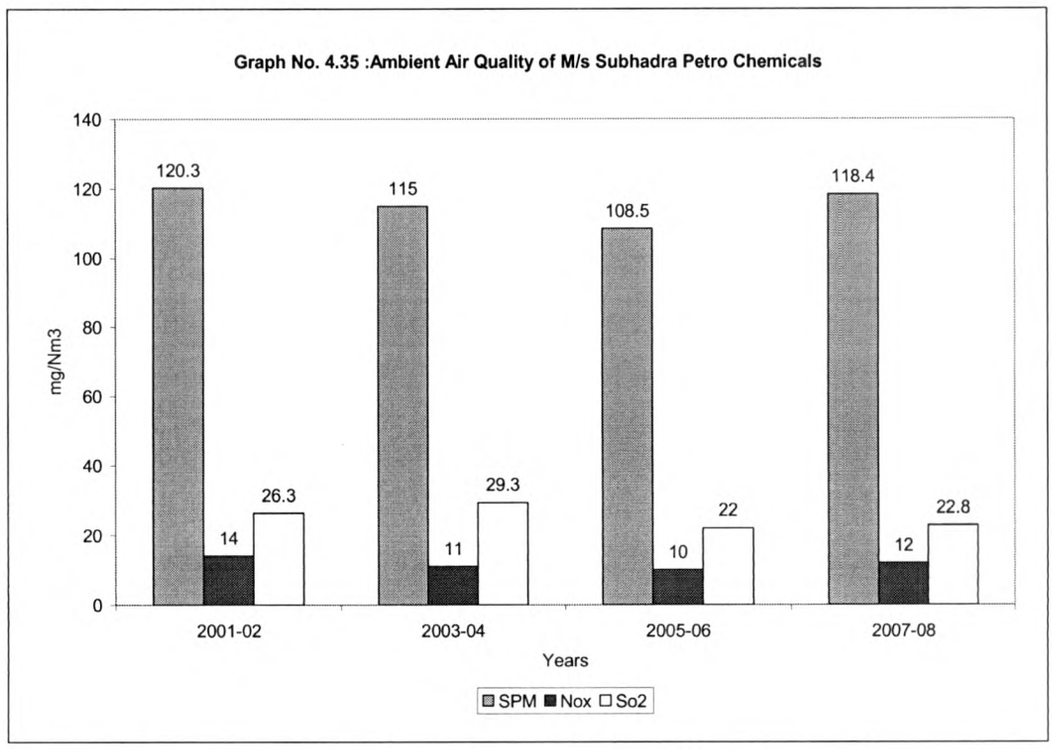
Table 4.5.3.2.3 a

Ambient Air Quality of M/s Subhadra Petro Chemicals

(mg/Nm^3)

Year	SPM	No_x	So_2
2001-02	120.3	14	26.30
2003-04	115.0	11	29.30
2005-06	108.5	10	22
2007-08	118.4	12	22.80
CGR	-1.19	-5.42	-6.90

Source : Same as of Table No. 4.5.3.2.1



In the above table, the concentration of SPM, No_x and So_2 is given for 8 years of study period. In 2001, SPM concentration was recorded at 120.3 mg/Nm^3, which slightly decreased to 118 mg/Nm^3. The SPM concentration is reduced in 1.19% during the study period whereas the concentration of No_x and So_2 is reduced by 5.42% and 6.90% during the study period. In short, from the above table it is clear that M/s Subhadra Petro Chemicals has become successful in reducing SPM, No_x and So_2 keeping them in the limits of MPCB.

4.5.3.2.4 Hazardous Waste

M/s Subhadra Petro Chemicals has generated hazardous waste from process only. This can be shown in the following table.

Table No. 4.5.3.2.4

Hazardous Waste of M/s Subhadra Petro Chemicals

(in kg.)

Hazardous Waste	2001	2002	2003	2004	2005	2006	2007	2008	CGR
From Processes	75.80	78.90	80.50	82.40	83.50	88.90	92.30	106.95	4.24
From PCF & ETP Sludge	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	-

Source : Same as of Table No. 4.5.3.2.1

In 2001, M/s Subhadra Petro Chemicals has generated 25.80 kg. hazardous waste, which increased over the study period upto 106.75 kg. The net increase in hazardous waste generation was recorded at 4.24% and its was less than permitted quantity of MPCB, that is 200 kg. of per year. Hence, it can be said that M/s Subhadra Petro Chemicals is obeying environmental auditing rules and complaining against MPCB norms.

4.5.3.3 Environmental Auditing of Symbiosis Co-operative Pharmaceuticals Ltd.

Like, above mentioned other small scale industries environmental auditing practices of this final firm is empirically analysed in the following sub sections.

4.5.3.3.1 Water Consumption

As a manufacturer of ayurvedic and allopathic medicine, Symbiosis Pharmaceuticals did not consume any quantity of water for cooling purpose. Against these MPCB norms, the actual water consumption is given in the Table No. 4.5.3.3.1.

Table No. 4.5.3.3.1

Water Consumption of Symbiosis Co-operative Pharmaceuticals Ltd.

(in CMD)

Year	Process	Cooling	Domestic	Total
2001	1 33.33	-	2 66.66	3 100
2002	1 33.33	-	2 66.66	3 100
2003	1 33.33	-	2 66.66	3 100
2004	1 33.33	-	2 66.66	3 100
2005	1 33.33	-	2 66.66	3 100
2006	1 33.33	-	2 66.66	3 100
2007	2.5 55.55	-	2 44.44	4.5 100
2008	2.5 55.55	-	2 44.44	4.5 100
CGR	5.96	-	-	5.96

Source : Environmental Statement Reports of M/s Symbiosis Co-operative Pharmaceuticals Ltd. for the financial years 2001-2008 submitted to MPCB Sangli.

In the above table, water consumed in processing purpose was recorded at 1 CMD in 2001, which increased in 2.5 CMD in 2008. The process water consumption increased by 5.96% during the study period. The percentage share of process water consumption stood at 35.5% in 2001, which increased to 55.25% in 2008.

Whereas domestic water consumption was recorded at 2 CMD, which comprised percentage share of 66.66% in total water consumption, which remained the same in 2008 but its percentage share declined to 44.44% during the study period.

The total water consumption was recorded at 3 CMD in 2001 that increased to 4.5 CMD in 2008. Increase in total water consumption was recorded at 5.9 CMD during the study period. There were high standard deviations of 69.44 found in both process and total water consumption. Likewise, there was a perfect positive correlation found between process and total water consumption.

4.5.3.3.2 Raw Material Consumption

Productwise raw material consumption of Symbiosis Pharmaceuticals is given in the following table.

Table No. 4.5.3.3.2 a

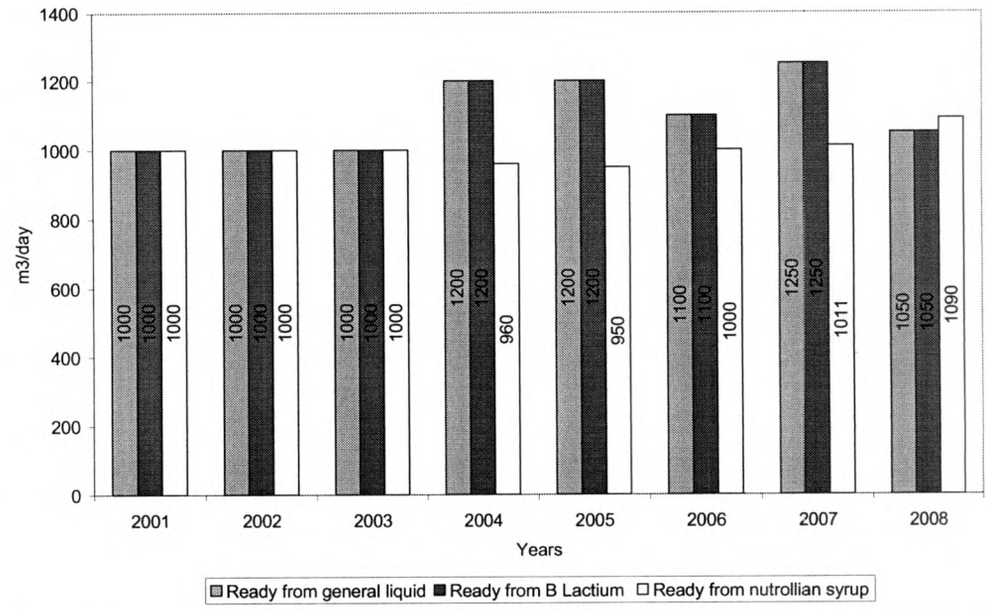
Raw Material Consumption of Symbiosis Co-operative Pharmaceuticals Ltd.

m^3/day

Name of the Raw Material	2001	2002	2003	2004	2005	2006	2007	2008	CGR
Ready from general liquid	1000	1000	1000	1200	1200	1100	1250	1050	2.09
Ready from B Lactium	1000	1000	1000	1200	1200	1100	1250	1050	1.23
Ready from nutrollian syrup	1000	1000	1000	960	950	1000	1011	1090	0.77

Source : Same as of Table No. 4.5.3.3.1

Graph No. 4.36 Raw Material Consumption of Symbiosis Co-operative Pharmaceuticals Ltd.:



In the above table for producing general liquid ready form of general liquids are used at 1000 litre to produce 1000 litre output in 2001. The ratio slightly changed in 2008 in which 1050 litre of raw general liquid was consumed in producing general liquid. The consumption of raw general liquid increased by 2.09% during the study period.

Likewise, for producing 1000 litre of B lactium, the raw B lactium was consumed for 1000 litre in 2001, of which the ratio also slightly changed during the study period. The consumption of raw B lactium was increased by 1.23% during the study period, which reduced at 1020 litre of raw B lactium in producing 1000 litre of B lactium.

Likewise, 1000 litre of raw nutrollian syrup was consumed for producing 1000 litre of nutrollian syrup in 2001. The consumption of raw nutrollian syrup was increased upto 1090 litre to produce 1000 litre of nutrollian syrup. The reduction was recorded at 0.77 during the study period.

From the above table it is clear that consumption of raw general liquid, B. lactium has increased and consumption of Nutrollian syrup has reduced during the study period.

b) Fuel and Energy Consumption

As a source of energy, electricity consumption of Symbiosis is given in the following table.

Table No. 4.5.3.3.2 b

Energy Consumption of Symbiosis Co-operative Pharmaceuticals Ltd.

(Kwh/year)

Year	Electricity
2001	201
2002	345
2003	482
2004	493
2005	505
2006	687
2007	229.94
2008	326.82
CGR	2.97

Source : Same as of Table No. 4.5.3.3.1

In the above table the consumption of electricity was recorded at 201 Kwh/per month in 2001, which seen at 326 Kwh per month in 2008. The consumption of electricity was increased by 2.97 during the study period.

4.5.3.2.3 Pollution Discharge to Environment

The polluting practices of Symbiosis Pharmaceuticals are summarized in the following sections.

a) Pollutants Discharge to Environment

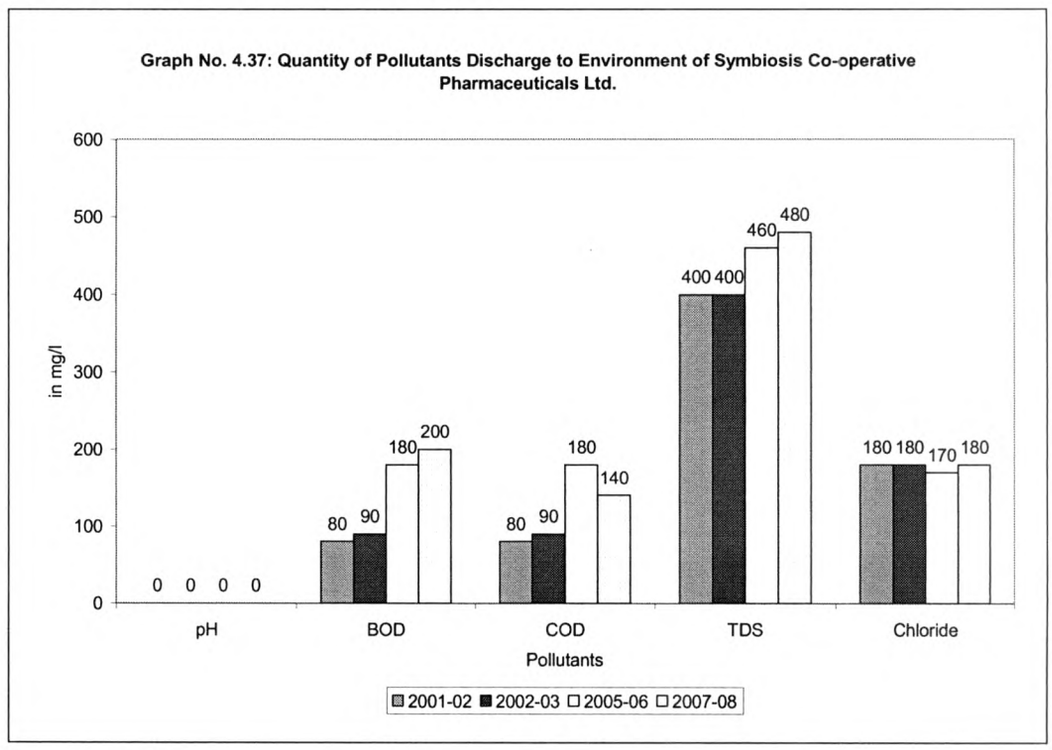
Quantity of water pollutants, which was discharged into water by Symbiosis Pharmaceutical is shown in the following table.

Table 4.5.3.3.3

Quantity of Pollutants Discharge to Environment of Symbiosis Co-operative Pharmaceuticals Ltd.

Pollutants	2001-02	2002-03	2005-06	2007-08	CGR
pH	-	-	-	-	-
BOD	80	90	180	200	41.08
COD	80	90	180	140	20.16
TDS	400	400	460	480	7.10
Chloride	180	180	170	180	-0.56

Source : Same as of Table No. 4.5.3.3.1



In the above table, water pollutants in its quantity discharged into water is shown.

1. pH

As per data reported in environmental statement reports pH values were not reported.

2. BOD

In 2001-02 BOD values were recorded at 80 mg/l, which increased in 2007-08 to 200 mg, which were double than permissible limits of MPCB, that is BOD should not exceed 100 mg/l. Hence, it can be suggested that it should try to reduce the BOD quantity and compliance against the MPCB norms.

3. COD

In 2001-02, the COD values were recorded at 80 mg/l and 90 mg/l in 2003-04, which were in the limits of MPCB that COD should not exceed 100 mg/L. However, in the next 4 years values for COD increased and recorded at 180 mg/l in 2005-06 and 2007-08, it was recorded at 140 mg/l. The overall increase in COD values was recorded at 26.76% over the study period. The COD values were higher than the permissible limits. Hence, it is suggested to reduce the COD values and compliance against the MPCB norms.

4. TDS

The total dissolved solids were recorded at 400 mg in 2001, further they increased to 480 in 2007-08. The overall increase was recorded at 7.10% during the study period. Even though they have increasing trend, they are also in the limits of the MPCB norms.

5. Chlorides

The values for chlorides were recorded in the range of 170 to 180 mg/l during the study period. Moreover, this range was in the limits of the MPCB.

In short, from the above table it can be said that in the case of COD and BOD values in which increasing trend was observed, Symbiosis Pharmaceutical tried to reduce the BOD and COD requirements and in the case of TDS and chlorides Symbiosis Pharmaceuticals has ensured compliance against the MPCB norms during the study period.

B) Ambient Air Quality

Ambient air quality gives concentration of air pollutants and gaseous pollutants on the premises of Symbiosis Pharmaceuticals Ltd. These can be given in more detailed in the Table No. 4.5.3.3.3 b.

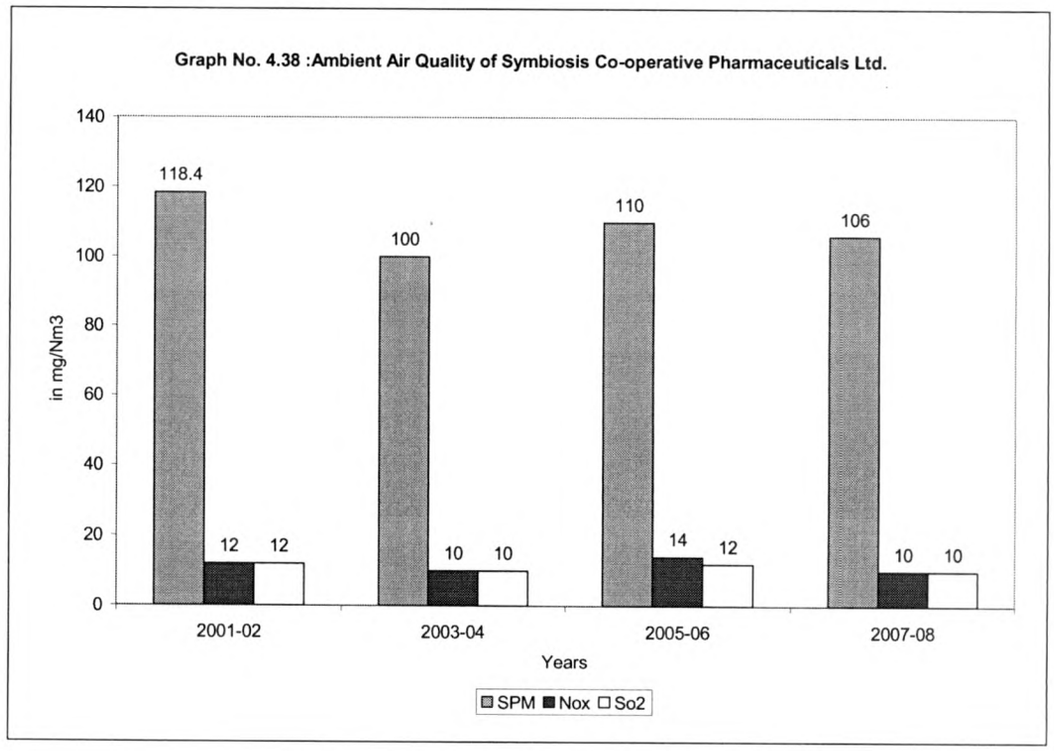
Table No. 4.5.3.3.3 b

Ambient Air Quality of Symbiosis Co-operative Pharmaceuticals Ltd.

(mg/Nm^3)

Year	SPM	No_x	So_2
2001-02	118.4	12	12
2003-04	100	10	10
2005-06	110	14	12
2007-08	106	10	10
CGR	-2.23	-2.8	-3.58

Source : Same as of Table No. 4.5.3.3.1



In the above table the concentration value for SPM was generated at 118.4 mg/Nm^3 in 2001, which decreased to 106 mg/Nm^3 in 2007-08. The net decline was recorded at 2.33% during the study period.

Likewise, the concentration of No_x and So_2 were recorded at 12 in 2001 and the concentration values reduced to 10 mg/Nm^3 in 2008. The reduction was recorded at 2.18 and 3.58% during the study period.

In short, from the above table it is clear that the Symbiosis Pharmaceuticals has reduced its all types of concentration values of pollutants and ensured compliance against the MPCB norms.

c) Waste Water Quantity

The table No. 4.5.3.3.3c shows waste water quantity generated by the Symbiosis Pharmaceuticals Ltd. during the study period.

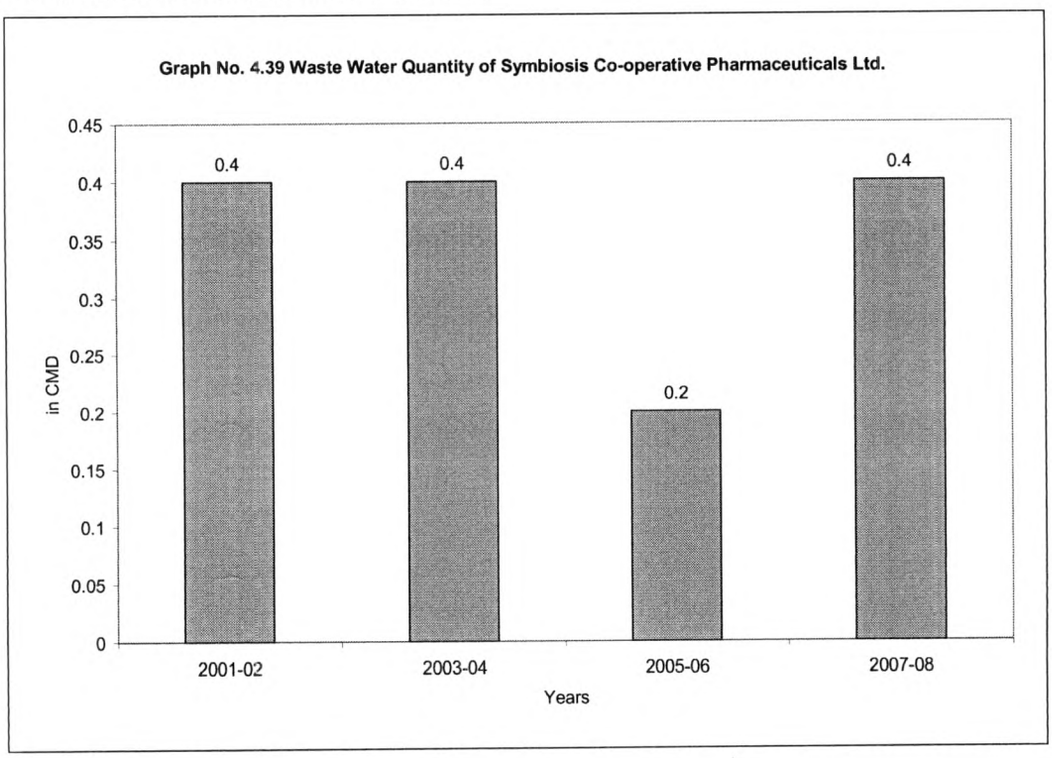
Table No. 4.5.3.3.3 c

Waste Water Quantity of Symbiosis Co-operative Pharmaceuticals Ltd.

(in CMD)

Year	Waste Water
2001-02	0.4
2003-04	0.4
2005-06	0.2
2007-08	0.4

Source : Same as of Table No. 4.5.3.3.1



The Maharashtra Pollution Control Board has given 2 CMD water quantity as a maximum limit for waste water quantity. Against this norm, the actual waste water quantity was recorded at 0.4 CMD during the study period, except 2005-06 in which waste water quantity was equivalent to the norm of 0.2 CMD. Hence, it should try to keep waste water generation in the limits of the MPCB.

4.6 Concluding Remarks

An empirical analysis of environmental auditing reveals that industries of Sangli district have accepted environmental auditing in their full forms. Environmental auditing as it stands involves monitoring of environmental management system of the industry, checking the status of consent orders, compliance against consent orders, water cess submitted to MPCB, Sangli, other necessary legal documents, industrial data collection regarding product, process, electricity consumption, raw material consumption, raw material to prepare material and energy balances was collected. An empirical analysis of environmental auditing practices is a study of documents and reports to see whether there are any deviation between targets and results. Our study reveals that all the sampled industries in Sangli district for our study have been involved in environmental auditing. They attempting for implementation of provisions in environmental auditing. We have got a mixed picture of success of environmental protection through environmental auditing by the industries in Sangli district.

References

1. Patil, D. D. and Pathak, Rajesh (April, 1999), Common Effluent Treatment Plants, PRAKRUTI – An in-house Magazine of Maharashtra Pollution Control Board, Mumbai, Vol. 2, p. 20.
2. Badrinath, S. D. and Raman, N. S. (Dec. 1993), Environment Audit – A Management Tool, Indian Journal of Environmental Protection, Vol. 12, No. 13, p. 881.
3. Raman, N. S. and Dr. Devotta Sukumar (2006), A Handbook on Indian Standards, Jointly published by National Environmental Engineering Research Institute, Nagpur and Maharashtra Pollution Control Board, Mumbai, p. 27.
4. Kopkar, S. M. (2004), Environmental Pollution Monitoring and Control, New Age International Pvt. Ltd., p. 198.
5. Jain, S. K. (Sept. 1993), Environmental Auditing of Ambient Air Monitoring : A Procedure, published by Indian Journal of Environmental Protection, Varanashi, Vol. 15, No. 11, p. 804.
6. Consent Order granted to M/s Jolly Board Pvt. Ltd. by Pollution Control Board (April, 2002), p. 2.
7. Mhaskar Ashok Keshav (1996), Environmental Audit, Media Enviro, Pune, p. 61.
8. Desai Vasant (1999), Small Scale Industries and Entrepreneurship, Himalaya Publishing House, Mumbai, p. 15, 31.
9. Padma B., Rao S. and Ramban (1999), Environmental Audit Process – An Opportunity for Cleaner Production Systems, Indian Journal of Environmental Protection, Varanashi, Vol. 19, No. 10, p. 760.